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IMPROVEMENTS IN GAS MACHINERY.

We continue to-day our report of the Meeting at Chicago of the American Gas Light Association, and we have no doubt that our readers will be much interested in the paper by General Hickenlooper, on "Steam Stoking Inventions and the Relations they bear to Gas Interests," and the discussion upon it. The General's review of the situation is clear, comprehensive and concise. Security from competition, closed doors and a secret industry, company officers unfamiliar with details of business, "practical" but unscientific management, all these are referred to as causes that may have existed in the past; but their days are numbered, and the near future must be met by the highest intelligence, the most practical skill, and the most thorough scientific knowledge and training, if the vast industry upon which the comfort and safety of millions of people depend is to keep pace with the demands of the times.

Mere brute force, and expenditure of human muscle, cannot accomplish this any more than the enormous crops of this country could be gathered by hand without the reapers and other agricultural machines which the engineers of the present day have devised. The old saying about "making two blades of grass grow where one grew before" has a widespread application, and in no case a more pointed one than in the manufacture of gas. Every arrangement that relieves the working man from wear and tear of muscle is a benefit to the human race. A unit of work may be defined as the expenditure of power necessary to raise one pound one foot in a unit of time. Now, let any manager of a works take his pencil and compute the number of pounds of weight which has to be raised one foot every day in his retort house, and then let him compute what this would be per minute, and he can form some idea of what the human stoker has to endure. Add to this the unfavorable conditions under which this labor has to be performed, the transitions of heat and cold, the smoke and steam, and the air he breathes, and who can wonder that many humane engineers have spent much time, labor and money in trying to substitute steam for man power in the performance of this work. Humanity alone should demand the accomplishment of this end. We are well aware that a corporation is said to have no humanity, and, what is worse, no soul—but every corporation has one vital point, and that is known as "profit."

Show the most soulless corporation in existence how it may develop this one vital point, and increase its magnitude by the smallest percentage, and it becomes all eyes and ears. Now, it is at this point, as we look at it, that all the obstacles to advance are to be found, The first query offered is, "What will it cost?" Upon being shown clearly that, although the first cost may be something, still the ultimate saving will be large, the cautious sentinel at the treasury door only replies, "It is too much;" "Can't afford to pay that amount;" "No, sir; you must get something cheaper to accomplish the same result;" "A bird in the hand is worth two in the bush!" etc., etc. This kind of policy may do for a time, but it cannot prevail against all comers in the future. Radical defects demand radical changes, and the matter may as well be met now as at any future time. As renewals have to be made they should embody the best practice up to date, and where new developments present themselves they must be taken advantage of, and the works adapted to the improvements, and rebuilt, if necessary, to get the fullest advantage of them.

The present moment is a most favorable time for considering these questions. From all parts of the country we are informed that there is a general increase in the amount of business being done by our gas makers. In some places the increase is 10 per cent., while in others it is as high as 15 or 20 per cent. over the send out of last year. This is gratifying intelligence, and should induce every man to put his works in thorough running order to meet the increased demand. This can be best and most economically done by having plenty of producing plant so as never to be crowded or obliged to work at disadvantage. It is true that many points remain unsettled as to what is really the best practice; but the prudent soul who waits till all these points are settled will die of an extreme old age, and, in the meantime, lose money enough to try a dozen different systems and secure some additional profit from each of them.

To raise the retort houses up out of the mud, to put in furnaces that will save more than half the fuel now burned, to get the best settings, to apply machinery to the handling and charging of coal and the drawing, breaking, and delivery of coke, to substitute steam and hydraulic power for human power, these are some of the problems that must enter into the designing and erection of the retort house of the "near future." It is folly to sit down and say that in any one of these particulars our people are unable to cope with the difficulties of the case. We feel sure that the talent is only waiting for the call and it will respond with alacrity. Not gratuitously should any one expect to have the result of any man's brainwork; but money spent is sometimes money saved—get the best, pay well for it, and the result cannot be doubtful. We know that many minds are working on the above problems, and are confident that with any reasonable encouragement on the part of those who control the policy of the companies, results are sure to follow that will tend to cheapen the cost and the selling price of gas, and, at the

same time, largely extend its use. The example shown by the Cincinnati Gas Light and Coke Company in this respect is one worthy of all praise; and the results, as set forth in General Hickenlooper's paper, are proof positive of the financial success of mechanical applications in their works. The statement made by General Hickenlooper that his coal was never touched *by hand* from the time it left the yard until its coke was dumped on the sidewalk at the customer's house, is a statement of which any man should be justly proud; and we are glad to be able to record this fact which, it is believed, can be said of very few other men in the world.

[Communicated Article.]

"Are High Heats Economical?"

In the discussion of the letter of Mr. George Livesey, which appeared in your issue of October 16th, it is important that we should know the following particulars before we can tell whether it will pay to use cannel or not, viz.:

The cost of the cannel and caking coal per ton when delivered in the yard; the price received per bushel for the coke; per gallon for the tar and the liquor, at the works; also, the yield of gas, coke, tar, and liquor per ton of the material.

So, for this purpose, we will suppose that the price of the caking coal is $5 per ton; the price received per bushel of coke, six cents; per gallon of tar, three cents; per gallon of liquor, one-half cent. The yield of gas per lb., 4.50 cubic feet, of 16 candle gas, or 72 candle feet; the yield of coke per ton, 40 bushels; of tar, 10 gallons, and of liquor, 20 gallons.

That the price received per bushel of coke from the cannel is three cents; per gallon of the tar, three cents; per gallon of the liquor, one-half cent. The yield of gas, per lb. of the cannel, is 4.50 cubic feet of 36 candle gas, or 162 candle feet; the yield of coke, 32 bushels; of tar, 12 gallons, and of the liquor, 20 gallons; and that the cost of the purification will be about the same in both cases.

We will base our calculations on the work done by one of the Dieterich benches of sixes, with retorts $20'' \times 12'' \times 102''$. One of these benches will easily burn off 10,800 lbs., or 4.82 tons of coal in the 24 hours, with 25 per cent. of the coke which it makes.

Now, the question is, what sum may be paid for the said cannel, under the conditions before mentioned, to make the cannel exactly equivalent to the said caking coal in the matter of economy.

CAKING COAL.

Dr.

4.82 tons of caking coal at $5.00	$24.10
48 bushels of coke at six cents	2.88
1.75 men at $2.50 per day	4.38
Wear and tear of benches, etc	1.00
Total cost for coal, etc	$32.36

Cr.

192 bushels of coke at 6 cents	$11.52	
48 gallons of tar at 3 cents	1.44	
96 gallons of liquor at ½ cent	48	
		$13.44
Total cost of materials for the gas made		$18.92

10,800 lbs. × 72 candle feet = 777,600 candle feet.

1000 candle feet will cost $18.92 \times 1000 \div 777{,}600 = \$0.02433$.

The decimal $0.02433 will be carried on and used again in the equation for the cannel.

CANNEL.

Dr.

4.82 tons of cannel at x dollars	$ 4.82x
48 bushels of coke at six cents	$2.88
1.75 men at $2.50 per day	4.38
Wear and tear of benches, etc	1.00
Total cost for coal, etc	4.82x$ + $8.26

Cr.

154 bushels of coke at three cents	$4.62	
58 gallons of tar at three cents	1.74	
96 gallons of liquor at ½ cent	0.48	
		6.84
Total cost of materials for the gas		4.82x$ + $1.42

10,800 lbs. × 162 candle feet = 1,749,600 candle feet.

1000 candle fee will cost $(4.82x + 1.42) \times 1000 \div 1{,}749{,}600 = \$0.2433$.

Hence— $4820x + 1420 = 42{,}567.768$

$4820x = 42567.768 - 1420$

And $x = \$8.54$

Accordingly, one ton of the said cannel, at $8.54 per ton, will be equivalent to one ton of the said caking coal at $5 per ton in the way of economy, unless a greater candle power is required than that which can be obtained from the caking.

Consequently, if the Newcastle coal, which Mr. George Livesey mentions, costs 15 shillings per ton, when delivered in the yards, yields 4.375 cubic feet per lb., of 15½ candle gas, or 68 candle feet; and the cannel costs 30 shillings per ton, and yields 4.60 cubic feet per lb., of 30 candle gas, or 135 candle feet, then I am quite sure that it will not pay to use that cannel, unless they require a greater candle power than the Newcastle will give alone.

The cost of the gas per thousand cubic feet, at exit of retort house, may be readily obtained by multiplying the cost per thousand candle feet by the candle power required; and accordingly, in this case, a 16 candle gas will cost $\$0.02433 \times 16 = 38.92$ cents per thousand cubic feet.

By substituting other figures for those given in the preceding formulas for the prices paid and received for the several materials, etc., results may be obtained which will accord with the prices for the same in any locality.

111 BROADWAY, N. Y., Nov. 13, 1880. WM. FARMER.

Mr. Editor: I have read with much interest the article from the pen of Mr. George Livesey, of London, as published in your last issue. The question he raises as to the economy of running high heats is a very important one.

A great step in advance in the manufacture of gas would be gained if the point could be definitely settled as to where the economy in the carbonization of coal ceases. Doubtless most gas engineers have experimented more or less in this direction, and have arrived, in a rough way, at the point where it is not safe or economical to carry their heats higher. From my own experience in daily working, taking Penn coal (for, I presume, that what Newcastle coal is to England, Penn coal is to this country), and after corrections to standard pressure and temperature, 10,500 feet per long ton (for the sake of comparison) of 17 candle gas at the works is, I find, about the maximum economical yield.

I have arrived at this conclusion from the fact that when I endeavored to get 11,000 feet per ton, certain results invariably followed.

1st. A reduction in the illuminating power of 1½ candles.

2d. An increase of fuel of more than 10 per cent. While 34 bushels of coke per bench per 24 hours will produce 10,500 feet, it takes 38 or 39 bushels to produce 11,000 feet.

3d. The stand pipes begin to stop up, and this I consider to be an expensive and serious evil. It is at this point that I believe the illuminating power is reduced. The highly-heated retort converts the light-giving vapors into lampblack and soot. These are carried along with the current of gas into the stand pipe and gradually stop it up.

4th. And it follows, when the gas is denuded of these light giving vapors or naphthas, that naphthaline is deposited in the service pipes. This is invariably the case whenever I have the heats which I consider too high.

So that, having to pay those four expensive items for the extra 500 feet, leaves no doubt in my mind that a high yield of gas, per ton of coal carbonized, is *not* an infallible test of good management.

Respectfully,

JAS. SOMERVILLE.

American Society of Civil Engineers.

The Twenty-Eighth Annual Meeting of the American Society of Civil Engineers was held November 3d, 1880, and the following officers were elected for the ensuing year.

President—James B. Francis.

Vice-Presidents—Ashbel Welch, Octave Chanute.

Secretary and Librarian—John Bogart.

Treasurer—J. James R. Croes.

Directors—C. Vandervoort Smith, Joseph P. Davis, D. J. Whittemore, G. Bouscaren, William H. Paine.

As suggested by a circular recently issued the Annual Meeting (after the presentation of reports and the canvas of the votes), was adjourned to meet on Wednesday, November 17th, 1880, at 10 A.M.; at the Society House. The morning meeting of November 17th will be occupied with discussion on Society business. Arrangements are in progress by the members resident in New York, for a special meeting, with professional papers and discussions, for visits to points of engineering interest, for collations, and for a reception. These arrangements will extend over the day and evening of both Wednesday and Thursday, November 17th and 18th. All members are invited to be present.

JOHN BOGART,

NOV. 4TH, 1880. *Secretary.*

[Official Report.—Continued from page 206.]

Eighth Annual Meeting of the American Gas Light Association.

Held at Chicago, Ill., October 13, 14, and 15, 1880.

Afternoon Session—Oct. 13.

Mr. Wood—I do not think that large stand pipes would remedy the difficulty. We commenced running our higher heats, getting present results while having the old 14-inch hydraulic main. The stand pipes started from the mouthpiece at 4 inches and ended at the hydraulic main at 3 inches. In rebuilding one set of benches we put in a larger main and 6-inch stand pipes, and expected immediate relief; but we had none. We had about the same experience with a 6-inch stand pipe that Mr. Forstall has detailed in his paper. We had fully as much trouble with them as we had with the smaller ones. There is no question but that with high heats you will have stopped stand pipes; and a superintendent or engineer of a gas works who boasts of having no stopped stand pipes can be pretty well assured that he is running low heats.

Mr. Starr—We are carbonizing about 1650 pounds per charge; sometimes it runs down to a little less, but that is the average. We have six retorts, and carbonize from 275 to 300 pounds per retort per charge.

Mr. Helme—A few years ago I was in Dumfries, where Mr. Malam was running his process, from which great results were expected. He ran his heats as high as he could get them. Dr. Wallace and Mr. Harrison were there examining the process at the time. I noticed that he used water on the outside of his pipe. Right at the top he had a very small trough, less than one-sixteenth and more than one thirty-second of a inch in diameter, along which the water dropped. Immediately under the stand pipe in the mouthpiece there was a 6-inch pipe, which went into the main on the floor. The result was that all of the vapors which were carried down by the water escaped below; and although he had such high heats, he had no trouble from stopped pipes.

The President—Was it a jet of water, or a dropping?

Mr. Helme—It was a constant dropping. In Mr. Wood's case the water appears to have lodged on the floor of the mouthpiece, but here there was an escape below the mouthpiece, by means of a 6-inch pipe running into a wide-open trough. There was quite a large amount of water running away from the 9 retorts which he used, and he charged from the other end, where there was no stand pipe at all.

Mr. Wood—That is more water than should be used. It does no require so much.

Mr. Sommerville—I was sent, some time ago, to a gas works where they had stopped making gas, and they wanted to know what was the matter. I found that they had been running very high heats, and had been charging very small charges. The stand pipes were all stopped up. They employed a gang of men, and we found that the hydraulic main was one mass of pitch, and the pipe leading from the main to the condenser, as I afterward found, was also one mass of pitch. In fact, we had to take it out and kindle a large fire and burn it out. I was obliged to get to work as quickly as I could, and I did not take all of the pitch out of the hydraulic main, but only a portion of it. I started the men to charging, and told them to leave in the mouthpiece a shovel of coal, and go ahead. We never had the stand pipes stopped from that time on, and that is the remedy I always apply. A few days ago I had in my works something which is very unusual—a stopped pipe. I told the men to shovel cold coal for a little while on the floor of the mouthpiece. My idea was that this cold coal would cool these vapors. It always has had the effect, in my case, of cleaning the pipes.

Mr. Forstall—We have tried that plan, and it was almost invariably successful. We put the last shovel of coal in the mouthpiece. But it is a costly remedy, and one that I do not like to adopt. I should like something more scientific. In regard to the Malam process, which Mr. Helme spoke of, in addition to the jet of water in his stand pipe he uses a sort of punch bowl, into which the water drops, and there is a constant evaporation going on in that bowl which most thoroughly and effectively cools the mouthpiece. So that in every case where I can derive relief to the stand pipes from the use of water, it indirectly comes right down to cooling the mouthpiece. But the ascension pipe might just as well, and more profitably, be left hot, because some of the vapors that are condensed in the cooled ascension pipes are those that ought to go into the hydraulic main, and we therefore lose some of our residual products. The object should be to condense in the mouthpiece only such vapors as we cannot carry forward, and let the others pass off without being condensed in the stand pipe. I wish to say, before this discussion is ended, that I do not intend to let the matter rest here. I intend to test it most thoroughly by methods which I think will be best calculated to arrive at a correct solution of the problem, and I will report the result at the next annual meeting. (Applause.)

Major Dresser—I will state that two cases have come within my knowledge during the last two months, where the same trouble existed as has been referred to. In one case it was Mr. Stedman's works, at Newport. They applied Mr. Wood's remedy, and found that it worked satisfactorily. The other case was in Derby, Conn., where the Dieterich furnace had been put in. The furnace did its work perfectly for about two weeks, when, all at once, this stopping of stand pipes took place, so that they were unable to make the quantity of gas they had been making. They applied a similar remedy, dropping water into the pipes, and that relieved them.

Mr. Odiorne—Since this discussion commenced I have learned from the superintendent of the works at Plymouth that his attention was called to this process by Mr. Stedman, of Newport. Previous to that he had been very much troubled by the stoppages in his stand pipes and in his hydraulic main. He had to clean them out every week. He says that he has had no stoppages since he began to use Mr. Wood's process.

Mr. Wood—I do not wish the members of the Association to be misled in relation to this matter. It is not Mr. Wood's process by any means. It was devised by somebody else, and I tried it and found it effective. It was devised by a foreman, and put in operation in a small works in Courtland, N. Y., over which I had some supervision. He tried it and found it very effective. He had modified the process somewhat. After he found it effective with small stand pipes he applied for a patent, and in the Patent Office he came across a patent for a somewhat similar process. I think he then changed it somewhat, and instead of making the usual joint in the stand pipe at the mouthpiece, he put some cotton waste in there, and let the water run on that. I have learned within a few days that he succeeded in getting a patent on his process. How it was done, whether by introducing water through the cotton waste or not, I do not know. At any rate, I do not wish it to be understood that it is my process, because it is not. I simply tried it and found it effective, that is all.

Mr. Odiorne—The stand pipes at Plymouth were 4 inches, and only about 8 or 9 feet long.

Mr. Allen (Poughkeepsie)—You are pleased to say that I am the Methodist class leader of the water gas process, and I suppose that when the class gets into difficulty the leader ought to say something. If I have anything to say I shall be but a few moments about it. I think the difficulty the gentlemen complain of is radical. You have never succeeded in making gas under your present process without these difficulties occurring from day to day. It looks to me as if a merchant might just as well expect his boxes of dry goods to move across the street without any power to move them, as to move that mass of carbon from your retorts without a power to carry it. The trouble is, there is no power, and no permanent supporting gas to carry the amount of carbon in the coal. It must become deposited in your retorts, in your stand pipes, and in your hydraulic mains, for want of a permanent supporting gas to carry it. When you come to the point that you make a pure chemical gas in your retorts, and perfect it there, you will have no trouble between that and your holder, and your consumers will have no trouble in burning it. When you can get in your gas a proportion of permanent supporting gas that will carry it off without clogging, you will then give your consumers a high candle power gas that will not smoke. Until you can do that you cannot furnish such a gas. You have been speaking of your troubles. Now, I say that our works at Poughkeepsie run day after day, month after month, year after year, and we send 100,000 feet of gas through 7-inch stand pipes without any such thing as clogging, without any ammonia in it, without any sulphuretted hydrogen in it, and without any of these troubles that you complain of. I hold that the reason is simply this—that the gas is not properly formed in the retorts, where it should be formed. After it leaves the retort you cannot make anything else of it except as it was when it left the retort, because the moment it gets to a lower temperature, all the chemical operation of it is wasted, except the condensing of that portion of it which has not become volatilized enough to pass off.

The President—Permit me to say that this discussion is upon the question as to how to prevent the stoppage of stand pipes, and not upon the the manufacture of gas either from coal or water.

Mr. Allen—That is just what I am now discussing. I say that you want a permanent supporting gas sufficient to take up the carbon as it is volatilized. That is just the point I want to make, and that is the point that I think will be arrived at much more generally than it is now. I say that we can take coal which will yield 20,000 feet to the ton and send in a permanent supporting gas sufficient to take up the whole of the carbon and chemically unite with it, and that will carry it off into your holders without any of the difficulties that you complain of. I say it can be done, and that we have done it. We have made 100,000,000 feet without any of these troubles.

Mr. Cartwright (Philadelphia)—Coal gas?

Mr. Allen—We use naphtha, and we use bituminous coal. It makes no difference what coal you use, nor how much carbon there is in it, if you have a permanent supporting gas ready at hand to take up the carbon as it becomes volatilized. If it is not there at the moment, then it becomes

deposited. There is no difference in the gas, whether you make it from oil or coal, because the oil is merely distilled from the coal in the great laboratory of nature. Anthracite coal is the coke of bituminous coal. I will now proceed more to the question as to how to handle that.

Mr. Forstall—Doubtless a man may be cured of the headache by cutting off his head. There is no doubt in the world that if we rebuild our works and go to making water gas we shall cure the stoppage of our ascension pipes. But we are looking for a cheap remedy, and I am afraid that proposed by Mr. Allen is a little too expensive. (Laughter.)

Mr. Allen—Let me answer that. If the gentleman will show me what it costs him to put this gas into his holders, I think I can convince him that we can put gas into his holder, of a higher candle power, perhaps, than he can make at his works, at a less cost than it now costs him.

Gen. Hickenlooper—I call the gentleman to order, and ask that he be good enough to confine himself to the subject under consideration. He is now wandering very far from it.

Mr. Allen—I would like to be heard in reply to the gentleman's remarks about cutting off heads. I am not talking upon such a foolish subject as cutting heads off.

Mr. Forstall—I only spoke in a Pickwickian sense.

Mr. Allen—This is not a Pickwickian subject, and I am not talking in a Pickwickian sense. This is a subject, I take it, of a good deal of interest. When I am headed off in a Pickwickian style, I ask to give some facts. I do not wish to cast slurs upon any one, and I do not intend to.

The President—It strikes me that you are discussing a subject that it is not proper now to go into, and which does not in any way belong to the matter treated of by Mr. Forstall in his paper. The discussion must be confined to the subject dealt with in that paper, and how to get rid of the trouble he speaks of.

Mr. Allen—That is just what I was talking about. (Laughter.) It can be done without much trouble, and I was attempting to show how. Whether it cuts off anybody's head or not I am not able to say.

The President—You have stated your position, and Gen. Hickenlooper has called you to order. It is perhaps proper for me to say that I have treated your digression from the subject immediately before us, as I suppose the Association is inclined to regard it; but if the members wish you to go on and defend your system I have no objection in the world, and I will at once put it to a vote.

Mr. Allen—No, sir; I do not wish to be heard at all.

The President—I do not wish to abridge the right of discussion, and it is for the Association to say whether they wish the discussion to be confined to the subject legitimately before us.

Mr. Allen—It seems to me that if I can show you how gas works can be run without the trouble complained of, and which is the subject of discussion, I am clearly in order.

The President—You have already stated how you proposed it should be done, and you are now discussing your system of making gas, which is not the question before us.

Mr. Allen—We have done it.

Mr. Cartwright—With coal?

Mr. Allen—I say we have done it.

The President—You have already stated your whole argument.

Mr. Allen—I was going to state one fact, if you will allow me. Mr. Allen, of the Astor House, told me the other day that he had used our gas during the summer in his private house, and he said that he never saw as pure, white, brilliant gas in his life, and we have not had a particle of trouble with our stand pipes.

Mr. Cartwright—I would like to ask Mr. Allen if he has any stand pipes at all.

Mr. Allen—We have one stand pipe for 100,000 feet. It is only a 7-inch pipe, and we have no trouble with it whatever.

Mr. Cartwright—And you do not use any coal except for fuel?

Mr. Burtis—What I understand we are trying to get at is this: How to keep our stand pipes free in manufacturing gas from bituminous coal, and not from anything else. Those who do not have this difficulty have no need of the remedy. I would like to ask Mr Forstall if he has noticed at what particular point of time the stoppage in his pipes takes place after the retorts are charged—how soon after the charge is put in?

Mr. Forstall—It was absolutely impossible to tell, because the stoppages are not constant. They will run over from one charge to another. These pitch stoppages sometimes occur in the middle of the charge, and sometimes at the end. Sometimes the pipes will be stopped at the beginning of the next charge, because the pitch has commenced to form above, and we have to clean our stand pipes between the charges. The stoppages from dry soot almost invariably occur within the first half hour after the charge is put in. They come very suddenly. I have tried very often to discover some regularity in their appearance, with reference to the periods of distillation, but I have never been able to make a satisfactory investigation on that point.

Mr. Burtis—In some little experience that we have had of that kind, I have noticed that the stoppages would appear to present themselves shortly after the retorts have been charged, but not universally so. We very rarely have stoppages in the bridge or dip pipes. Our stoppages occur mostly in the stand pipes, a short distance above the mouthpiece or on the lid at the mouthpiece; and sometimes I would have it removed and another lid put on. I never lost the charge, as Mr. Starr has spoken of. I was never troubled to that extent. Some time ago I noticed that condensation took place in the main very rapidly. I adopted a device of my own and used it at every bench having a main of its own, and I had an opportunity of observing the effect. I had an ordinary syphon arranged in such a way that I ran the discharge from the main over into any vessel that I saw fit lying on the floor, so that the sum total of the discharge from the main was run immediately off. I had that remain from the time the last retort was charged until the expiration of the four hours. I made a memorandum of the condensation, and nearly all of it was during the first half hour after the retorts were charged. I have no record of it here, but have at my office, and can tell exactly the quantity of coal that was charged, at what period of time the maximum of condensation took place, and at what period the condensation actually ceased. The impression left upon my mind was that if, in some way, we could get rid of a portion of the condensation after a particular time, we would have less stoppage, because almost all the stoppage that took place was immediately after the charge, just at the time I had determined the bulk of the condensation was taking place, and the ammoniacal liquor and the tar were being formed.

Mr. William Cartwright—I would like to ask Mr. Forstall if he has ever used Higgin's check plate?

Mr. Forstall—We have used two or three different check plates, Higgins's among them.

Mr. William Cartwright—Mr. Higgins, of Rome, N. Y., has a patent on a check plate, as he calls it. It was brought to my attention some years ago. We have used it occasionally in our works. We are not often troubled with stoppages, our pipes being 7 inches in diameter; but whenever we are and it gets to be a continuous thing, we put in these check plates. As long as there is a tendency for the pipes to stop we insert the check plates. Probably by corresponding with Mr. Higgins you can get what information you desire in regard to them.

Mr. Forstall—We have used check plates with some advantage, but I do not think the advantage compensated for the trouble of putting them in and taking them out, because it lengthened the time the retorts were opened, and increased the tar and pitch, so as to necessitate frequent cleaning. We came to the conclusion that the good they did was not sufficient, in our case, to warrant our using them exclusively. They gave us some relief, however. For instance, they would relieve us from a portion of the stoppage in the stand pipes, but would have no effect upon the bridge and dip pipe stoppages.

Mr. Cartwright—We have not had any trouble with our dip pipes whenever we have used the check plates.

Mr. Butterworth—Did you keep any record by which you could tell whether, when you had stopped pipes, you did not have a better yield and make more gas? My idea is that whenever you have stopped pipes you get a better yield.

Mr. Forstall—It was just the reverse with us. We had no stopped pipes in the summer. We very rarely have them at that time. In the summer we always make our largest yield, because, in order to save the men, we run our charges 4½ instead of 4 hours, and our yield is from 5.20 to 5.50 cubic feet per pound. Very often, on Tuesday nights, after the retorts have been idle all day, we have run up to 5.80 cubic feet to the pound. At such times this summer we have had no stoppages. On the contrary, in winter, when we have been troubled with naphthaline, we have had to run our heats down a little for the sake of getting rid of the naphthaline. At those very times we have had this trouble with the stoppage of the pipes.

The President—Are we to infer that those who say nothing upon this subject have no trouble from the stopping of their pipes? So far as our works are concerned, we have had very little trouble from this cause. It has never attracted my attention especially. Just before putting in the charge our men often use an instrument such as, I believe, is used by Mr. Forstall, to clean out the accumulated material. We have no trouble, however, so long as we use the regular coal. We did have some trouble when we used another kind of coal, to which I have referred.

Mr. Sommerville—Have you arrived at the conclusion that the trouble is the fault of the gases that come up the pipes?

Mr. Forstall—Not the gases, but the vapors. I am satisfied that the gas, after it leaves the retort, loses its heat very rapidly. The heat is retained by the vapors that form the tar and pitch. I think that these have a very high heat, and if we could arrest and cool them we would not have the heat which goes to form the pitch, and would entirely prevent the stoppages in every case. What I am looking for is not a partial remedy which will re-

lieve the stand, bridge, and dip pipes when they are stopped, but for something which will entirely and inevitably prevent the stoppage in any part of the apparatus. And from experience and thinking the matter over I do not think we can accomplish this unless we can stop these particular vapors which do the mischief, and take them out at that point where we can easily intercept them. I have no doubt whatever that the cooling of the ascension pipe by Mr. Wood, as I have said, affords relief by that very action. My difference with Mr. Wood is merely a difference of detail. It is not a difference of principle. He accomplishes in his ascension pipes what I want to accomplish in the mouthpiece. I would like to save a little more tar. I have no doubt that the cooling of the ascension pipe along its whole length will cause a greater condensation of tar, which must inevitably find its way to the mouthpiece, and thus we have a loss of our residual product.

The President—That raises the question of how much tar you save and how much tar Mr. Wood saves.

Mr. Coggshall—I have observed in my experience that when we were using iron retorts, producing only three and a-half feet, we had stopped dip pipes. We reach now from five to five and a-half, and I very seldom have stopped stand pipes. I use, of course, larger pipes than I had at that time. I have not, for years and years, had a stoppage of a bridge or dip pipe. I have stoppages, however, at the mouth of the retort. I have a half-inch hole in every lid, and I have a crooked rod, so that if we see there is any stoppage, we can run the rod in without taking the lid off the mouthpiece, and thus relieve at once the opening of the stand pipe. We lose no gas to speak of, for it is all done in a moment. That answers every purpose. I stop up the hole with mortar.

Mr. Fuller—I have had some experience with stoppages. I have had some correspondence with a party in regard to the remedy. I think the same party used, as we do, a crook made of a flat piece of iron a great deal smaller than the pipe (our's are 6-inch pipes), twisted half way round, something in the shape of a rainbow. We attached this crook to the end of a rod, so that we can run it up to the first joint. We had, some time ago, one that was an eighth of an inch, and with this crook attached we could run it clear to the stopper. Before we would draw our charge, or after the charge was drawn, we would insert both crooks. We have never had any trouble since, and have never had a stoppage. It is all done in a moment.

The President—We are now prepared to hear General Hickenlooper's paper.

Mr. Wood—Before General Hickenlooper commences, I would move that a vote of thanks be tendered Mr. Forstall for the very interesting paper he has submitted. (Carried.)

General Hickenlooper then read a paper entitled

STEAM STOKING INVENTIONS AND THE RELATIONS THEY BEAR TO GAS INTERESTS.

In presenting a brief outline of the important subject embraced in the above title, it is not particularly flattering to the vanity of the controllers of the vast interests so unreservedly confided to our care, for me to assert without fear of contradiction, that no manufacturing industry of equal magnitude, inaugurated during the present century, has derived less aid from mechanical appliances than that of the manufacture of gas.

While we are frequently disposed to congratulate ourselves upon the wonderful growth of the industry we represent, may we not well stop to consider how much of that growth can properly be attributed to the uncultivated demand for an article of prime necessity, and how much to intelligent and successful efforts made to improve the quality and decrease the expense of its production.

With the single exception of the exhauster, no important advance has been made by the utilization of steam power since the days of Clegg, for in all other essential feature gas is, to-day, made and distributed as it was over half a century ago.

Why has such a condition of affairs existed? Certainly not because there has been no demand for such assistance, or desire for improvement, for I doubt if there is a single member of the profession who will not admit, or does not fully appreciate, the advantages to be derived from the adoption of any new and improved system of retort house labor, which would result not only in reducing the cost of manufacture, but in rendering us less dependent upon the expensive, peculiar, and exacting class of labor upon which we are now compelled to rely for continuous and unceasing production.

Can it be that it is because, in fancied security from competition, we have sat ourselves down to enjoy the present at the expense of our future, or have we too zealously guarded the sacred precincts of our retort houses, or made of our business too select or secret an industry, whereby mechanical experts and inventive geniuses have been deprived of an opportunity of studying our system and supplying our wants? Or is it because, as a general rule, the controlling officers of our companies are unfamiliar with the details of manufacture, and the works managed by practical but unscientific men, so engrossed by the cares and responsibilities of their positions that they have neither time nor derire for great mental exertion or co-operative action?

If this be true as a rule, there are certainly notable exceptions, for some of the brightest intellects and most highly educated and accomplished engineers of the country are to-day identified with gas interests; and even where such men as these have failed, success has not unfrequently been achieved by men possessing less culture but greater natural talents, who, contending against difficulties innumerable, have fought their way up, step by step, from the very humblest walks of life to the highest pinnacles of fame.

I can therefore see no valid reason why we should be so far behind in the race of improvement, or why this power, if properly and scientifically applied, should not, in the near future, perform as great wonders for the gas producer as it has already accomplished for other industrial pursuits, when it converted the low hum of the spinning wheel into the music of a thousand spindles, or substituted the lightning-like flash of the locomotive for the lazy laboring of a rumbling coach.

To whatever cause past indifference or present delinquencies may be attributed, certain it is that hereafter we may expect to be called upon for the more general exercise of a higher degree of intelligence and nerve, the adoption of newer and more scientific principles of manufacture, and a broader comprehension of the necessities for keeping pace with the advances made in other departments of mechanical industry, through the substitution of steam power for the present slow and laborious work of the human stoker; for it is indeed humiliating to realize, that during an age celebrated for the wonderful achievements accomplished by the substitution of machinery for manual labor, the prevailing system of charging and discharging retorts should remain as it was before any of the gentlemen here assembled made their debut upon the retort house stage, and this, notwithstanding the numerous, but I fear feeble efforts which have been made to accomplish so apparently simple a task.

Maiben, of Perth, was the first to take a progressive step as early as 1814, by inventing his "horizontal rotary retorts," which were placed in successful operation at the Royal Mint, Birmingham, Chester and Bristol.

Mr. Clegg afterwards constructed one based on nearly similar principles, but of greatly increased capacity, for which he obtained letters patent in 1816, and soon thereafter followed with his "Webb retort," capable of extracting 11,000 cubic feet of gas from one ton of coal.

Mr. Brunton followed in 1835 with his invention for feeding retorts from a hopper, the coal being pushed forward into the retort by a piston working through a stuffing box, forcing the coke back into a water-sealed chamber at the opposite end.

Grafton followed, three years later, with his novel and ingenious invention of a scoop with closed end and sliding bottom, which, while being inserted, forced the coke out at the opposite end of a through retort, and as drawn back deposited the coal of a fresh charge.

Geo. Michael then followed with his patent for a steam stoker, to be operated in connection with huge brick through retorts, $30'' \times 9 \times 2$ feet into which the coal was charged through openings in the arch above, and from which the coke was pushed out by a ram beam with cast iron head, the whole operated by suitable machinery. This, I may say in passing, is almost identical with the machines now being used at Pittsburg for discharging coke ovens.

From this on, for a period of 20 years, little or no effort appears to have been made in this important direction, until 1860 H. Greene, of the Bolton Works, constructed a machine to which power was communicated through the agency of a square shaft operated by a stationary engine located at one end of the retort house, and upon which shaft were affixed movable spur wheels, connectable with the machinery, and thus operating an adjustable rake, and a scoop to be filled by hand but inserted, turned and withdrawn by machinery.

Wm. Malam, during the following year, invented a charging scoop which upon being moved rapidly forward with a shovel-like motion, and then suddenly stopped, projected the coal into the retort.

It was not, however, until 1865 that any real practical advance was made toward the accomplishment of stoking by machinery, in which year Messrs. Best & Holden invented a machine operated by steam. It consisted of a frame supporting a coal hopper, boiler, engine and machinery for operating the three rakes and scoops, which latter, being in a fixed position, necessitated a special arrangement of the retorts, and the charging and discharging of three at one time.

This objectionable feature was afterward overcome by Holden, to whom a patent was issued for an arrangement by which either of the rakes or scoops could be swung out at right angles, so that one or more could be operated at pleasure.

Geo. Simpson next followed in 1867 with a patent charger, which provided for metal trays filled with coal, to be deposited in ordinary retorts until car-

bonized, when they were to be withdrawn, discharged and refilled by suitable mechanical appliances.

The following year witnessed the introduction of Dunbar & Nicholson's machine, consisting of a combined scoop and rake, the latter working inside of the former, the whole moving upon an over-head trackway and operated by an endless wire rope or chain.

W. T. Carpenter, in 1869, and also in 1876, obtained patents for mechanical appliances which, in all essential features, appear to be but a repetition of those of Brunton, for which patents were granted in 1835.

Wm. R. Lake, of London, but a few months later, patented a scoop with a reversible web or apron bottom, operated by suitable machinery, communicating longitudinal and lateral motion. The general features of this apparatus bear a striking resemblance to those of the Grafton patent in 1838.

H. A. Bonneville, in August, 1869, received a patent for a machine, the principal feature of which was the formation of a scoop in two sections, which, upon being inserted in a retort, opened and deposited the coal below.

J. R. McFarlane, of Manchester, two years later, patented a combined rake and scoop, on the extreme end of which was an iron plate, so hinged as to preserve a horizontal position while entering, but when acted upon by a lever, descended and raked out the coke while being withdrawn. It also had a hinged bottom, through which the coal passed from the scoop to the retort.

In the latter part of 1871, Messrs. Somerville & Robinson, of the Dublin works—where the Best and Holden machines had been previously operated—received a patent for a steam stoker, the special feature of which consisted of a reversible scoop filled from a sliding chute as it entered the retort. Mr. Robinson, some years later, improved upon this by subtituting a divisible scoop in two segments, one of which folded over the other. The rake consisted of a U-shaped bar, in the hollow of which rested a light rod, by which the rake head was lowered or elevated. The whole operated by suitable steam machinery.

Messrs. Porter & Lane then entered the field with a novel apparatus for the production of gas through the agency of a vertical retort, to which prepared coal was automatically fed, and passed through in close contact with the sides of the retort by a permanent feed screw operated by steam, the coke falling into a coke box below, from which it was quickly removed by opening a self-sealing lid.

This was followed by the "Rowland Steam Stoker," which, although somewhat complicated, well represents the wonderful mechanical skill and Yankee ingenuity of its talented inventor.

Wm. Mann, of London, next entered the field, in December, 1872 with his separate steam charger and discharger. The coal being carried by a bucket belt to a receptacle from which it could be discharged into a scoop, divided into two parts longitudinally. When this scoop has entered the retort a suitable distance, it is sprung open and the charge thus deposited.

The rake-tube has a head with axial motion operated by a chain or rod within the tube, and at outer end has affixed a small scoop or shovel with which to loosen and remove the tar cake.

Wm. Foulis, of Glasgow, in January, 1873. received a patent for his "Hydraulic Stoker," the power being communicated to cylinders or tubes which, under hydraulic pressure, opened and closed telescopically. In the original design the coal was brought into the retort house in boxes the length and width of the scoop, and by a simple mechanical contrivance each box was raised from its truck, brought over the scoop, the bottom sprung open, and the charge deposited; hydraulic pressure then being applied, sends the scoop forward into the retort, inverts and withdraws it.

The discharging is effected by bringing the telescopic rake tube to the desired position and applying the pressure at alternate ends. The inventor, during the same and subsequent years, obtained patents for improvements, under which he operated the scoops by a chain or band connections passing over forward and rear drums; he also made the scoop attachable to the machine by means of a T-head catch fitting into a corresponding opening, by which arrangement he avoided the necessity for using supplemental scoops or trays, as, being removable, they could be filled at one side and then swung into position ready for use. Slight improvements in the rake were also made, by which some of its functions were automatically performed.

A few months later Messrs. Taylor, Buckley and Chadwick, of Oldham, patented a machine consisting of a scoop or box, with sliding bottom and rake attachments. When used, this combined scoop and rake was thrust forward into the retort, the rake heads turned down, and as drawn back it brings out the coke and deposits the coal.

Wm. Maquay, of Dublin, in February, 1873, patented a novel device for charging with coal contained in metal cylinders, at one end of a through retort, and discharging by means of a fixed rake, working through a stuffing box, at the opposite end, by which the coke was to be drawn into a closed well below.

W. Richards, during the same month, patented devices for drawing and charging, the latter being accomplished through the agency of a reversible scoop, and the former by the application of the motion generally known as the "lazy tongs." All mounted on suitable carriage and operated by steam.

Mr. West, of Maidstone, soon thereafter followed with his combined charger and discharger, consisting of a short scoop or wagon with movable bottom and shield in front, to be operated in a through retort by inserting at one end, driving it through, pushing the coke before it out at the opposite end, and dropping coal for a new charge as scoop is being withdrawn. This, it will be observed, bears a striking resemblance to the apparatus for which Grafton received a patent thirty-five years previous. This system of discharging, however, was never practically adopted, but in lieu thereof another machine was constructed, carrying a rake, upon the end of which is affixed a loose "hoe" and fixed "slipper," which latter causes the rake to slide over the coke until it has reached the desired point, when, by turning, the rake blade is inserted in the body of the coke, and upon being withdrawn brings out the charge.

J. Maxwell, of Glasgow, in October, 1873, received a patent for an apparatus consisting of a scoop or holder, charged with coal, to which proper momentum was to be given by inclined plane, swing, or steam piston, and upon being suddenly checked at the mouthpiece, projected the coal into the retort. This involves, practically, the same principles covered by the patent granted to Malam in 1861.

Darlington and Scott next entered the field, and obtained letters patent in November, 1873, for a machine which operated a reversible scoop and spiral rake; this latter being the new and novel feature of the invention. Being turned on its axis while entering, it is intended to pass through and loosen up the coke, and then, upon being withdrawn without turning, to bring out the charge.

Warren and Waters next received a patent, in July, 1874, for a stoking machine, to which power was communicated by means of an endless wire rope running the full length of the retort house, the scoops and rakes being operated by rotating screws and fixed nuts.

J. Rowbottom, in September, 1874, procured a patent for a stoker carrying a scoop with hinged rake head, which, when propelled into a through retort, pushed the coke out at the opposite end, and on the return stroke deposited the coal by moving the outer casing of the scoop back, outside of a stationary plunger, thus forcing the coal out of the end of the scoop while being withdrawn.

J. Steele, of Glasgow, in August, 1875, received provisional protection for a device by which coke could be discharged from a retort through the agency of a steam or compressed air blast.

A. M. Clark, of London, during the following year, received a patent for placing coal in metal cylinders or cases, to be inserted in ordinary retorts; and also for a scoop, with a plug or plunger held in position by a stiff spring, which on being released forced the coal out of the scoop as it was being withdrawn from the retort.

J. Warner, of South Shields, next followed, in 1877, with a patent for a stoker, the general feature of which are two vertical cylinders or hollow rams, on each of which is mounted a cradle for carrying the reversible scoop and rake; the whole forms a quadrilateral frame 10 feet by 3 feet, mounted on wheels and operated by an endless wire rope. The scoop and rake cradle is free to turn on the rams, and may therefore be worked at any angle. It is necessary to the introduction of this appacatus that material alterations be made in any existing plant, and the form of settings be adjusted to the requirements of the machine.

Quite recently MM Servier, Monnier and Rouget, of Paris, have introduced to public notice a hand charging machine, consisting of a hopper of sufficient capacity to hold six charges, opening at the bottom into a barrel distributer or coal valve, regulating the discharge into twin sheet iron scoops, about 4 feet in length, located upon a small cast iron car, to be driven into the retort by windlass and chain connection. The scoops are required to enter twice, and are turned by the movement of a square shaft trunnion and pinion located between the scoops. It appears to be practically but a less efficient combination of the principles before adopted by Rowland and West.

From the foregoing enumeration it will be apparent that considerable time and attention has already been given to the consideration of this important subject, and while it is no part of the object of this paper to criticise these efforts. I may well be excused for saying that a critical examination of the various principles involved in their construction, and the conditions necessary to their introduction, leave but little room for surprise that so few should have proved of sufficient practical importance to attract general attention or warrant words of hearty commendation.

The Ross Steam stokers, to which I now desire to call your special attention, and for which letters patent have been secured in Great Britain, Germany, Belgium, France, Canada and the United States, are not like many of their predecessors, the attempted crystallization, of crude ideas based upon superficial or theoretical knowledge, but are the results of four years of patient and undivided thought, study and experiment, upon the part of a man to whom the wide field of applied mechanics contains but few untrodden paths.

During this period many different machines were, by him, devised, built, practically tested, and finally abandoned as not fulfilling all the conditions which, in his judgment; were essential to complete success, leaving the ones which he now presents for the consideration of the gas world as the embodiment of all that was good or worth preserving out of the mass of accumulated information thus obtained.

As the duties assigned are essentially different, so also are the machines, which he has constructed separate and independent in order that each may be made to perform its own work, in its own way, and upon its own schedule time.

In order that you may more clearly comprehend the detailed description of these machines, which will now be given, I herewith submit working models, and several copies of an engraving taken from a photograph, showing them as they appear in action at the works of the Cincinnati Gas Light and Coke Company. (See cut on page 209 of this Journal, issue of Nov. 2.)

The *Discharging Machine* consists of a carriage or rectangular platform 14 feet in length by 8 feet in width, resting upon two longitudinal and five transverse wrought iron 6 inch I beams; the former 8 feet in length, two of the latter 13 feet 3 inches, and three 8 feet 3 inches in length, all united by angle plates and rivets, forming a light and durable frame, carried upon 4 24 inch flanged wheels, 4 inch face, and keyed to 2½ inch axles 9 feet 2½ inches long, with bearing journals 2 by 6 inches, moving upon an eight foot gauge permanent trackway laid upon the retort house floor, parallel to face of benches. On one side of this platform are located the boiler, with independent feeder, pop safety-valve, steam-gauge, etc., water tank, and light direct reversing propelling engine. The boiler is 7 feet in height by 38 inches in diameter, with inside fire-box, and ten 6 inch rivetted flues.

Located transversely across the other side is a rectangular frame, the horizontal braces of which are the guides for the reciprocating traveler. This frame consists of two vertical cast iron columns bolted to the ends of the transverse platform beams, and having three wrought iron pipe struts secured by 1-inch tie rods passing through their centres.

The column nearest the bench is provided with guides for the reception and vertical play of a sliding box, which the operator can raise or lower at will, and upon which are affixed grooved rollers and flat-faced wheels turning on studs to sustain and guide the rake bars, any one of which can be clamped to the traveler or to the rear column when out of use. The traveler is a hollow cast iron cross-head, riding between the guides upon duplicate grooved friction rollers above and below.

The rakes are operated by means of a horizontal steam cylinder of 36 inch stroke, located parallel to, and on the right of, the guides of the traveler; the piston rod is attached to a cross head moving in guides and carrying a toothed rack, which gears with a gun metal pinion shrouded at either end, and thus giving an alternating rotary movement to the pinion-shaft journaled beneath the platform, upon which is keyed a drum carrying a chain, thence around grooved idler-rollers, turning upon studs secured at the sides of the front and rear columns respectively, and secured, upon opposite sides, to the traveler. By this means the reciprocation of the piston produces a corresponding movement of the traveler carrying the rake bars, and by suitably adjusted hand valve gearing the length and direction of the stroke can be varied by the operator at will. The speed of the traveler is governed by a water cylinder located on a prolongation of the line of the steam cylinder and connected therewith by a solid piston. A pipe connects the opposite ends of this water chamber through which the water displaced from one end is forced back into the other; the permitted rapidity of displacement being by the full way cock placed thereon.

A special means of cushioning the impact at the end of the stroke is provided for by locating an air chamber beyond the displacement port, into which the water is forced; this chamber is provided with an automatically acting air valve which closes upward as soon as the water commences to rise in the chamber, and opens as soon as the pressure of air in the chamber equals that of the atmosphere.

These governing devices are supplemented by rubber buffersprings on the traveler.

The rake beams are of rolled angle iron 4½ inches by 1½ inches by 11-16 inch tapering from rear to front.

The rake-heads are steel castings of any shape suited to the size of the retort, hinged to the ends of the rake beams by rule joints which permits them to turn freely under the beams, should they meet with any obstruction while being projected forward over the coke in the retort, and to assume a vertical position when brought into contact with the charge during the outward movement.

The whole machine weighs about 7,000 pounds, and can be at once introduced into any existing retort house having not less than 16 feet of space between mouthpieces and side wall, without any change or preparation other than laying the track upon which it is to be moved.

The *Charging Machine* consists of a rectangular carriage 10 feet in length by 9 feet in width, the framing of which consists of two longitudinal and four transverse 6 inch I beams, united by angle plates and rivets, and mounted on two pairs of track wheels 12 and 24 inches in diameter, keyed to 2½ inch axles.

Upon one side of the platform covering this framing are located the boiler, steam reservoir, water tank and propelling engine. On the other portion is mounted the supplemental carriage carrying the coal hopper, together with the devices for elevating and controlling it.

The steam boiler and attachments, as also the propelling engine, are duplicates of the ones upon the discharging machine.

The steam reservoir is a vertical cylinder six feet high by 2½ feet in diameter, the space between it and the boiler being occupied by the water tank.

The supplemental carriage consists of two triangular supporting frames of wrought iron pipe, rising about 10 feet above a square base mounted upon track wheels arranged to run upon rails laid upon the main platform, and upon which it is moved to and fro, by hand windlass and chain connection. Across the top of this frame is journaled a horizontal shaft, which also forms the top brace of the supplemental carriage; the side braces also forms guides for the hopper, which, being loosely adjusted, admits of a free vibration. The "hopper" is suspended between the two side frames by chains winding upon sheaves keyed to the shaft above, upon the projecting ends of which shaft are secured, at one end a brake-wheel and at the other a sheave, having thereon a winding chain attached at its free end to the piston rod of an upright cylinder, secured upon the platform of the supplemental carriage and against the vertical brace of the adjacent triangular frame.

This cylinder is single acting, and as its chain winds in the opposite direction from those supporting the hopper, it operates directly against the weight of the hopper and its contents. Steam is supplied to this cylinder through a swivel jointed pipe, which having a three way cock answers also for an exhaust. This elevating mechanism and attached brake wheel enables the operator to instantly adjust the coal hopper to any desired height.

The "hopper" is a funnel shaped sheet-iron vessel, divided by vertical partitions into three compartments, each containing sufficient coal for one charge. These partition plates are so hinged at their upper edges that the coal contained in each compartment can be alternately discharged into the conduit below.

In the rear of this conduit is located a pipe with a series of jet nozzles, horizontally disposed, so as to discharge against the coal and thus project it into the retort.

The connection is made between the conduit and the dry steam reservoir, by a swivel-jointed copper pipe which accommodates itself to the movement of the supplemental carriage.

The discharge is effected by opening a "Wilson" or other quick opening valve, located near the steam reservoir, which, with the lever of the propelling engine, the three way cock of the hoisting cylinder, and the brake lever, are all located within convenient reach of the operator.

It will thus be seen that the fundamental principle of this system of charging, is a dry steam or compressed air blast, used explosively, in direct contact with the charge of coal, without the intervention of any mechanical appliances; the mechanism otherwise employed is of the most simple and durable character, enabling a single operator, by the exercise of ordinary skill, and with but trifling personal exertion, to control every movement necessary to the successful operation of each machine.

In the practical operation of these machines, at the works of the Cincinnati Gas Light and Coke Company, an attendant strikes the lids from three retorts, or one-half of a bench, the discharging machine is then brought into position opposite the upper retort, with the corresponding rake pinned to the traveler, when the operator, with his right hand on the lever used for controlling the vertical play of the rakes, and his left upon the valve lever of the steam cylinder actuating the traveler, elevates the guide bar to admit the rake-head into the retort above the charge; and as the rake is projected forward, should it meet with any obstruction, it folds back under the rake-beam, and again assumes a vertical position when the obstruction is passed or the withdrawal begins. His position is at such a distance from the mouthpiece that it gives him every opportunity for observation unembarassed by the heat or smoke arising from the expelled coke, and the thrust being gov-

erned by the automatic devices before referred to, his entire attention can be centered upon the direction of the movement and the vertical adjustment, perfectly governed by the two levers under his immediate control, enabling him to arrest, renew or reverse the movement, or to elevate or depress the rake head at any desired point. The tar cake is first removed by a short stroke, followed by such other movements—usually from four to six—as may be found necessary to clear the retort; the whole occupying not exceeding 15 seconds.

This rake-beam is then detached from the traveler and pinned to the column, the next lower one shifted into position and the discharging operation repeated.

The discharging machine is closely followed by the "charger," which, having been coaled by chutes leading from the bins, conveniently located along the side of the retort house, is moved into position opposite to, and in a vertical line with, the lower or first retort to be charged.

The operator then runs forward the supplemental carriage by its hand propelling windlass until the guide flange of the conduit enters the mouthpiece, and effects a discharge by three or four quick openings of the Wilson valve, so graduated that the first blast will project a portion of the charge to the rear of the retort, the succeeding blasts depositing their charge uniformly in front of it. The skill necessary to do this perfectly can be acquired by any intelligent workman in a few hours.

The hopper is then moved back a few inches and the main carriage run to one side far enough to allow the lid to be closed by an attendant in the usual manner. While this is being done, the hopper is being elevated to the level of the next retort, where it is held by the brake before referred to, the partition plate sprung open, admitting coal to the conduit from one of the other compartments, the machine moved into position in front of the next retort, the secondary carriage moved forward, the valve opened, and the retort charged as before, which operation occupies about six seconds from the adjustment of the conduit to the mouth of the retort, until the whole charge is deposited.

After three retorts have been thus charged, the "hopper" is lowered, drawn back upon the supplemental carriage to its limit of travel, the machine propelled to the nearest coal chute, and the hopper filled as before.

This process is repeated as often as desired, or to the limit of the working capacity of the machine, which, including re-coaling, etc., will, with one operator and one assistant to each machine, average over sixty retorts per hour. Out of this a certain amount of time must necessarily be allowed for rest of operator, replenishing fire, watering, oiling, etc.

At our works a pair of machines have, with apparent ease, drawn and charged twenty-seven benches, or one hundred and sixty-two retorts, which, with four hour charges, gives forty minutes work and twenty minutes rest.

The guaranteed capacity of these machines—one retort per minute—appears to make it unnecessary for me to enter into any very accurate detailed estimate of the saving due to the introduction of such a system, for this must, to a great extent, depend upon the cost of retort house labor in any works with which it is desired to institute a comparison.

I will, however, submit a few facts and figures, based upon our own experience, in order that you may at least be able to form an approximate estimate of the pecuniary advantages attending their introduction.

In fairly considering this subject, it must not be forgotten that many of the changes which it appears advisable to make, in order that the best possible results may be obtained, carry with them their own attendant advantages, and should not, therefore, be taken into consideration unless placed to the credit of machine labor. Take, for example, the handling of the coal, which, by the aid of suitable mechanical appliances, can be prepared, elevated, stored in bins, and run into the hopper of the machine, at much less expense than is now required to place it on the retort-house floor by manual labor, and if, as should always be the case, this storage capacity is in excess of the daily demand, night work, always the most expensive, can be entirely dispensed with, and a constant supply of dry coal be kept conveniently near.

The discharged coke can be disposed of in exactly the same manner as if drawn by hand, which makes it unnecessary to introduce the cost of delivering coal and removing coke in any statement of comparitive cost.

No very accurate estimate can, as yet, be made of the depreciation and cost of repairs, but certain it is that the latter will be much less than the sum now expended in repairing and renewing retort-house tools, and will not, therefore be included in the estimate.

The maximum working capacity of one pair of these machines can be fairly fixed at 30 benches, or 180 retorts which gives 45 minutes work and 15 minutes rest, and the operation of which will be covered by the following estimated expense:

Interest on investment, say $10,000 at 6 per cent..	$600 00
Depreciation, say $10,000 at 10 per cent.....	1,000 00
4 Engineers (2 d. and 2 n.), 365 days, at $2.50.....	3,650 00
2 Assistants (1 d. and 1 n.), 365 days, at $1.75.....	1,277 50
4 Lid-men (2 d. and 2 n.), 365 days, at $1.50.....	2,190 00
10 Firemen (5 d. and 5 n.), 365 days, at $2.00.....	7,300 00
Fuel—coke, 30,000 bushels, at 4 cts.....	1,200 00
Water—city, 700,000 gallons, at 10 cts.....	70 00
Oils, cylinder, 62 gallons, at 80 cts.....	49 60
Oils, lubricating, 62 gallons, at 25 cts.....	15 50
Oils, illuminating, 40 gallons, at 20 cts.....	8 00
Packing, 30 pounds, at $1.....	30 00
Cotton waste, 100 pounds, at 10 cts.....	10 00
Men, 20; cost.....	$17,400 60

Producing 20,491,830 cubic feet per man, at an expense of 4½ cts. per 1,000.

To perform this same service under the present system of retort house labor (four men to five benches), requires the services of 48 men (24 day and 24 night), for 365 days, at $2.50 = $43,800; producing 8,538,242 cubic feet per man, at an expense of 10.68 cts. per 1,000 cubic feet, showing a saving of $26,600 per annum on one pair of machines, or 6.43 cts. per 1,000 cubic feet manufactured.

While this saving will be proportionately greater in large, and less in small works, their use can be made profitable enough to warrant immediate introduction in any works having in action over six benches in one range.

In considering the adaptability of such a system, it must not be expected that these machines, unlike any others, can be kept in constant and continuous operation, day and night, for years at a time, without being temporarily thrown out of action for cleaning and repairs.

The controllers have therefore wisely decided to furnish with each order one pair of reserve machines at exact cost of construction, leaving the charge for "working machines" to be fixed according to the following schedule:

One pair, twelve thousand dollars.....	$12,000
Two pairs, twenty-two thousand dollars	22,000
Three pairs, thirty thousand dollars.....	30,000
Four pairs, thirty-six thousand dollars	36,000

which is believed to be only about six months' saving, due to working them up to their maximum capacity.

I am perfectly aware that the consideration of this important subject is in no sense new to the members of our profession, and that they, no less than myself, appreciate the advantages due to its successful accomplishment.

But I do fear that the gravity of the situation, and the necessities of the hour, have not sufficiently impressed themselves upon the minds of our people.

The vast and constantly increasing use of illuminating oils, the pressure of water gas theorists, and the prospective possibilities of the electric light, all conspire to admonish us that the time for prompt and decisive action has arrived; that we should no longer await the result of future possibilities, or the action of our neighbors, in order that we may profit by their experience. It must not be expected that our interests will prove any exception to that inexorable law—the survival of the fittest—or that profits such as we have enjoyed in the past are to be hoped for in the future by those who are satisfied to sit still while the balance of the world is moving on. Each should put his shoulder to the wheel, and together aid in progressive movements all along the line.

It will not hereafter be accepted as a sufficient excuse that such a course will involve expenditures not warranted by present profits, or that existing works are not designed to suit the new order of things—they must be made to do so, and without delay, in order that we may, to some extent, make amends for the errors of the past, and avert the penalty of thoughtless improvidence, *gradual decay*.

Applause followed the reading of the paper.

The President—This matter is now open for discussion. I presume Gen. Hickenlooper will be very happy to answer any questions that may be propounded. It may be, however, that members may prefer to wait until morning before entering into a discussion of this paper, as it is now a little past five o'clock.

Mr. Helme—I think it may be a good subject to start with in the morning. It is now a little too late to go into the matter thoroughly.

Mr. Forstall—I think we should conclude the subject to night. It is now only a little after five o'clock, and the paper is fresh in the minds of the members. To-morrow morning they will probably have forgotten some details and some questions they may now wish to ask. I am sure Gen. Hickenlooper prefers to have it discussed to-night.

The President—I hope the discussion will proceed briskly, and that the members will not wait upon each other.

Mr. Forstall—I have no questions to ask. I simply wish to say that I

have studied the subject of the steam stoker, and our manager has done the same. The result of our examination has been that we have ordered four machines.

The President—That is very valuable testimony.

Mr. Helme—The very first time I saw it it impressed me very favorably. I thought it was with that, as with every new machine, that some little improvement could be suggested. The only real difficulty I see in it is that it costs a little too much for small companies to take hold of. I think Gen. Hickenlooper spoke about six benches. That would be about thirty retorts. I do not doubt that it could be used to advantage in that case, because one or two of the men that the General spoke of could probably be dispensed with, for the reason that you would not want to charge as rapidly as you would with a large number of retorts. There are, however, a great number of works running less than thirty retorts, and such works might find it expensive. I saw a mechanical stoker that Mr. Somerville had in Dublin some years ago that was very much more costly than this. I have also seen two others.

Major Dresser—With reference to the time that is employed in the use of these machines, I will say that I was in Cincinnati last spring and spent several days in investigating this subject. I went into the retort house at odd times, without any one knowing that I was coming, to time the operation. I saw several times eighteen retorts drawn and charged in sixteen minutes. That seemed to be about the rate at which they were working right along, and they only had two men on the machines and the men opening and shutting the lids as referred to by General Hickenlooper in his paper.

The President—Did that include the time taken to fill the hoppers.

Major Dresser—Yes, sir; because the time occupied by the drawing machine is longer than that occupied by the charging machine. The charging machine can work faster than the discharging machine; consequenty they utilize the time they are waiting for the retorts to be drawn in filling their hoppers and getting ready to go on. The whole thing is regulated by the rapidity with which the retorts can be drawn. When you time the drawing machine you time the whole operation. It is a question for any large works whether there could not be some arrangement made by which it would not be necessary to use one charging machine with each drawing machine—whether one charging machine could not charge the retorts for two drawing machines, if it could be made to work satisfactorily. The time for charging a retort averaged six seconds, as the General has stated. The time for drawing varied somewhat, according to the character of the charge.

There was another thing that struck me very particularly in regard to the matter, and that was the uniformity with which the coal was distributed on the bottom of the retort by the charging machine. Mr. Edge used to say that if he could have a retort charged exactly as he wanted it, he would have about three and a-half to four inches all over the bottom of the retort. The work of this machine comes as near to that standard as anything I have ever seen. There was no piling up of the coal; it was laid with great evenness and exactness. The first coal was sent to the rear of the retort, the next one just in front of it, and the next just in front of that. When the lids were opened to discharge the coke, you could see exactly the condition in which the coal was left by the charging machine. In going through eighteen or twenty retorts, you will see no variation. The whole thing is done without any trouble. I was told that one of the men who was operating one of these machines, which discharged 18 retorts in 16 minutes, had never been on the machine before that morning. The regular man was sick or away, and they took a man out of the works to fill his place. He was an American, and, of course, not a blundering man; but at the same time he was not a man of more than ordinary intelligence. I think that here is a field wherein very many gas companies can save a vast amount of money, and not only that, but an immense amount of wear and tear upon the human system, which now takes place in the work as done by stokers. The men are removed so far from the fire that it is not disagreeable work to run the machines.

The President—And its use, in a great degree, creates independence of strikers.

Major Dresser—Of course. If you did not use the machine—if you simply had it in the corner of your retort house, ready for use in the time of a strike, it would be worth the cost of a machine. Where you have large gangs of men to deal with this is an important item.

Mr. Watkins—They cannot vote!

Mr. Hickenlooper—The Cincinnati Gas Light and Coke Company not being a municipal corporation, I have not considered that aspect of the question.

Mr. Page—It was my privilege, ten years ago, to be in the Dublin retort house shortly after the Somerville stoker was put in operation. Although that was heavy and cumbersome, it was a great step in the direction of substituting machinery for the manual labor of stoking, which, of all work, is unquestionably the most terrible in its effects upon the human system. When I saw those scoops run into the retorts and the coke withdrawn, I could not but take off my hat and give three hearty Yankee cheers for the steam stoker. But you all know the result of the Somerville stoker. The heat soon warped those long iron scoops, and I believe that before I came back to America the Somerville stoker was laid up for repairs, and I do not think it has been in operation since. But the one that I have had the privilege of seeing in operation twice at Cincinnati seems to me to embody, especially in the manner of charging, that feature of American invention that we find in the Howe sewing machine and the McCormick reaper. I can testify to what Major Dresser has said in reference to the time occupied in putting the coal in, and to what has been stated by General Hickenlooper on the subject in his paper. The coal is projected on the bottom of the retort just like this—"chip, chip, chip." As quickly as that the coal is in the retort. I am sure we must all agree, from the facts that have been presented here, that mechanical stoking is one of the greatest advances yet made in behalf of gas interests. Unquestionably, by-and-by there will be a change made in the mode of removing coke from the retort. Instead of doing it mechanically with the rake, I believe that some inventive genius will put steam in behind and shove the coke out.

Mr. Burtis—I have nothing to say about the merits of the machine, for I have never seen one. Last year I was in Cincinnati, and went to see it, but they were putting in a larger boiler, and the machine was not in operation. I have not had the pleasure of being in Cincinnati since that time, and have not seen the machine at work. A little over two years ago, when I was abroad, the Foulis machine was in operation both in Glasgow and Manchester. Having occasion to call upon the engineer of the works at Manchester, I made some inquiry in reference to the working of the machine. He took out his watch, looked at it, and said, "They have just commenced to draw a range of sixty retorts; the time is so and so. We will go around elsewhere, and come back presently and see how long a time it has taken them." He had not been in the retort house, and the men did not know they were being timed, so far as I know. We went around through the purifying house and elsewhere, and came back just after they were through charging. They had discharged and recharged the sixty retorts in just about an even hour. I saw nothing there at that time in reference to the warping of the scoops that Mr. Page alludes to. They were working there more effectively, I believe, than they were in Mr. Foulis's works. Everything went along very smoothly. Their coal was brought into the retort house in a different manner from that employed in Cincinnati. They have ponies, fine little animals, that seem to know their business as well as many men. They are attached to a little carriage that receives about three of these scoops. They come alongside of an iron crane which is attached to the scoops, the crane is swung around and the thing is put in its place. The time occupied in discharging and charging the retorts was very small, yet I am well convinced, from the statements that have been made here that, the Ross machine will do the work quicker than the Foulis machine.

The point that you made, Mr. President, about being independent of strikes, is one of the very things we should look to in mechanical appliances not only in the Ross stoker but in any other machine that will do the work as we wish it done. We know from experience that men are very apt to take advantage of our necessities, when we are, perhaps, in a dilemma, to demand that which is unreasonable. Now, if we have a machine to discharge the coke and charge the coal, then, when we have made our peace with the three or four men who manage them, we can put in ordinary men, with not much brain but a good deal of muscle, to break the coal and prepare it. We shall then, indeed, be independent of strikers, which is certainly a most desirable position to be in.

Major Dresser—There is another point in regard to the character of the labor employed on these machines. It is of an entirely different character from the ordinary stoking labor. It is more of the character of men who run stationary engines, or run upon steamboats, men who can be easily replaced, particularly in the small numbers which are required. In considering the matter of strikes, that is an important item. You can easily replace these men so few in number while it may be difficult to replace men who are sufficiently skilled to act as stokers, and where, in stoking by hand, a much larger number would be required.

The President—As it is now near the hour of adjournment, perhaps it would be better to let this subject lie over until to-morrow. It can be taken up at any time after we meet.

There is a matter that ought to be attended to at once, and that is the appointment of a committee to recommend a place for the next annual meeting. I appoint as that committee, Messrs. George B. Neal, Samuel Prichitt, and John H. McElroy, to report sometime to-morrow.

Upon motion made and seconded the thanks of the Association were tendered to General Hickenlooper for his very interesting and valuable paper.

On motion of Captain White, the Association then adjourned until the following morning at 9 o'clock.

SECOND DAY—OCTOBER 14TH.

The Association met at 9 A.M., pursuant to adjournment, and was called to order by the President.

The President—The first business in order is the report of the committee in regard to the place of the next annual meeting.

Mr. Neal—The committee are not yet prepared to report. They will, however, submit a report before the close of the meeting, and in ample time to give the Association an opportunity to act upon the question.

The Secretary—I move that the committee have further time for consideration. (Carried.)

The President—I think it would be well for the committee to report at 2 o'clock this afternoon.

The Secretary—There was a recommendation of the Executive Committee yesterday, which, in the hurry at the time, was not considered. The Committee recommend the Secretary to proceed with the printing of the next volume of our proceedings, which will contain the proceedings of the last Annual Meeting at Philadelphia, and of the present one. The custom of the Association has been to print every second year. I move that that recommendation be adopted. (Carried.)

Mr. Barrett—I would like to make the suggestion that volume four correspond with volume three in size.

The Secretary—We have adopted that size as a standard now. I would say, for the information of the new members, that they can purchase from the Secretary the back volumes. They are entitled, by their election, to volume three, but volumes one and two they will have to purchase at the cost price, $1.25. The gentlemen who have been newly-elected desire, of course, to have the proceedings from the earliest date of the Association. I have with me a few copies of volumes one and two and also of volume three.

Mr. Hickenlooper—I desire to say in addition to what I said yesterday, that, at first, I thought, that the application of the principle of charging, as described, viz.; the blowing in of the coal, would produce a prejudicial effect upon the retort. In order to demonstrate to me clearly that such would not be the case, Captain Ross first constructed a wooden retort, and cut it in two in the centre, longitudinally, placing the upper half upon the lower, and then projected the coal, by the blast, into the wooden retort. After having done so he raised the upper portion, and the concussion due to the blast was not sufficient to throw the upper half of this wooden retort off of the lower half. After having thrown the coal in he then raised the upper half off the lower half, and exhibited the coal laid in as evenly in the lower half as it could be put in by hand, or in any other manner. I was then satisfied that he was correct and endorsed his theory. We took his first experimental machine down to the works. There was an old bench there that had been abandoned. It was going to pieces, and in some places it was so loose you could take the pieces out with your hand. He charged that bench with coal. The concussion was not sufficient to dislodge any one of those pieces in the retort. That was proof positive to us that there was no concussion that would in any manner injure the retort.

The President—Is there any prejudicial effect upon the benches? What has been your experience in that direction?

Mr. Hickenlooper—Our experience has been very favorable. It has produced no unfavorable effect upon the benches. If there are any incidental effects, one of them is that it decreases the formation of carbon. I have no occasion, in the retorts that we have been using with the machine, to put in carbon pipes.

The President—I should like to know something more about the raking machine for drawing the charge of coke. I should like to know whether you can use it when the retort is partially covered with carbon, or when it is irregular, or when it has been shortened. It is sometimes the case that retorts become smaller than they originally were. I should like to know if the raking machine can be used advantageously under the circumstances I have named?

Mr. Hickenlooper—Certainly. There is no combination of circumstances of that kind that could not be overcome by the use of this machine. It can be put in, for example, if the carbon should be formed to any extent in the roof of the retort. The governing power is such that the rod can be elevated or depressed to any position in the retort. It can be put in six inches and drawn out, or put in two feet and drawn out, or put in its entire length and drawn out. The operator holds the lever which thrusts the rake bar in and out in one hand, and the lever that elevates and depresses it in the other. It is all done by a movement of the hand at the end of the rake.

The President—I suppose it is well understood that the operator stands on this platform?

Mr. Hickenlooper—Yes.

The President—I suppose it is understood that all these movements are made by the men standing on the platform by the use of the levers?

Mr. Hickenlooper—Are you speaking of the discharging machine?

The President—Either of them.

Mr. Hickenlooper—On the charging machine the operator stands on the platform, but on the discharging machine he stands alongside of the machine on the retort house floor.

Mr. Starr—What shape are your retorts?

Mr. Hickenlooper—Our retorts are 16 × 22, ovals.

Major Dresser—You also have D-shaped retorts, have you not?

Mr. Hickenlooper—Yes, D-shaped, slightly rounded at the corners.

Major Dresser—And there you use a D-shaped hoe on the end of the rod?

Mr. Hickenlooper—Yes.

Major Dresser—What is the effect upon the stand pipes of the steam being blown in in this way?

Mr. Hickenlooper—I think it has a tendency to prevent the stoppage of stand pipes. We have had no trouble from that source since we commenced using the machine.

Major Dresser—So far as you have been able to determine, is there any pulsation produced in the hydraulic main from the pressure of this steam?

Mr. Hickenlooper—Nothing perceptible on the gauge.

The President—Would there be any difficulty in using the machine in a retort house without a basement?

Mr. Hickenlooper—None at all. The only difficulty would be that there would have to be an increased width or space between the bench and the side wall of the retort house. This additional room would be necessary for the space occupied by the car in which the coke is thrown. The only change in the machine that would be necessary would be the lengthening of the rake and hoe, the machine having to stand at that additional distance from the face of the retort.

The President—The Manhattan Company of New York City, I understand, have purchased the right, and are making the machines.

Mr. Hickenlooper—Yes, sir; they propose to operate it in that way and allow room for the coke barrow between the bench and the machine. I will say that, with us, the coal is never touched by hand or shovel from the time the coal is loaded on the wagon in the yard until the coke is delivered to the consumer, probably miles away. We have a little truckway running into the yard, and a platform car. The bucket forming the body of the car is placed upon that platform, run to the portion of the yard from which the coal is being used, passes over a trackway to the crane, is elevated to the trackway above, placed upon scales and weighed, run in on a two-foot gauge trackway to the bins situated alongside of the retort house. The coal runs by gravity from the bins to the machine, is blown from the machine into the retorts, drawn from the retorts by the discharger, falls into a car situated in the cellar below, which runs on a trackway to the coke elevator, and is dumped into the coke bins; the coke runs by gravity into the wagon of the consumer or dealer, and is carried away. That portion of coke intended for use in the retort house, is deposited in a separate bin, runs by gravity on a buggy on a level with the retort house floor, and is carried to the bench where required for use.

Major Dresser—At the same time do you screen your coke?

Mr. Hickenlooper—Yes, sir; we have a double arrangement for screening, so that we get fine coke or breeze, which we use in our boilers about the works; the nut coke, which goes to the ordinary consumer, and the large coke, which goes to the manufacturer.

Major Dresser—How many hydraulic elevators do you use?

Mr. Hickenlooper—We have two for elevating coal and one for elevating coke.

[To be continued.]

[From the London "Journal of Gas Lighting."]

West of Scotland Association of Gas Managers.

The seventeenth half-yearly meeting of this Association was held at Port-Glasgow, on Friday, Oct. 1, Mr. R. S. Carlow, the President, in the chair.

The following is the

PRESIDENT'S ADDRESS.

Gentlemen:—At the outset of the very brief address which I mean to deliver on this occasion, you will permit me to return my sincere thanks for the distinguised honor you have conferred upon me by electing me to the presidential chair. I can assure you that I appreciate in the highest degree the feeling which induced you to place me in this proud position, and I am at the same time fully sensible of the further compliment of meeting in the town which is the scene of my daily labor. I am afraid that the town itself does not present to the outsider any of those very striking physical, romantic, or historical characteristics which obtain in many of the other towns of

Scotland, and, from a gas manager's point of view, I do not think the gas works will be sufficient compensation for the absence of such attractions. But such as the works are—and they are highly creditable to the Corporation of Port Glasgow—it shall be my pleasant duty at a later stage of the proceedings to show them to you.

At one time in the history of Port-Glasgow it gave fair promise to be a place of exceeding importance. It was, as you are all aware, meant to be the port for Glasgow, before engineers devised the great scheme of deepening the river Clyde, and it was selected by that city after the towns of Dumbarton and Troon had refused the shipping facilities which it demanded; but as the channel of the Clyde was widened and deepened the prospects of this town became dimmer and dimmer, at least so far as it was a dependency on its larger neighbor. Its civic rulers, both in the past and in the present, however, have done much to foster trade; and although dwarfed east and west by Glasgow and Greenock, it holds its own with wonderful pertinacity. It was here that the late Mr. Wood, the eminent shipbuilder, built and launched the first steamer which plied upon the Clyde—namely, the *Comet*—and since then some of the finest ships of the merchant navy which now crowd upon every sea have been launched from the port, and still the hammer of the busy riveter resounds from morning till evening, and tells of the construction of vessels which are to add still further to the fame of the Clyde shipbuilders. To this town, then, which is largely dependent upon the shipbuilding trade, I heartily welcome every member of the Association and I trust that these few historical sentences may not be without interest to you all.

But the history with which we have all, as gas managers, to deal is one not of trade, or commerce, or politics. True, the industry with which we are all connected is closely allied to trade and commerce. With the fluctuations of these departments our business increases or decreases, and these, in their turn, influence the profits earned by companies and corporations. But while this association of interests is plainly apparent, we alone have to deal with gas manufacture; and here the chief aim of every manager, whether he be a member of the Association or not, ought to be to produce gas at the lowest possible price, consistent with giving a pure article and of a high illuminating power. It is not the part of a comparatively young manager such as I am to stand here and give advice to those "fathers" in the profession who have, by industry, perseverance and scientific knowledge, secured for themselves the applause of their brethren and the respect and esteem of the communities in which they labor and live. I am delighted to see so many of these gentlemen present, and I trust that before the end of the day they will, by their discussion of the various items on the programme, not only contribute to the success of the gathering, but add to the store of knowledge of the younger men. It is for this purpose that we meet, and I fervently hope that the gathering in Port-Glasgow will not be without its reward.

In these days, when the spirit of competition is abroad, there is more than ever a loud cry for economy in the methods of production, and the manufacture of gas is by no means an exception to this general rule. Nor has the cry been unattended to. The past few years have seen the introduction of improved machinery and improved apparatus into our works, with the special object in view of minimizing or entirely superseding hand labor, of separating from the coal distilled the greatest amount of hydrocarbons, and of extracting more carefully than ever those valuable compounds which in the past were allowed, if not entirely to run to waste, to pass away in large quantities to the gasholder. Some of these appliances have very properly been consigned to oblivion, but others have come into practical use.

It has often been said that the place where the exercise of economy can have most effect is in the retort house; and there is much force in the statement. From the moment the coal enters the works until the distillation is completed, there are many points where men, if not properly watched, would make such blunders, either through carelessness or ignorance, as would seriously swell the expense of gas production; and I would therefore lay it down as the foundation for other good results, that there should be ample store-room accommodation for coal, and that the house should be so planned that the coal shall be within easy reach of the stoker. I think, also, that less attention has been paid in the past to the arrangements of furnaces and retorts than the importance of the subject demands. Those members who have at all studied the literature of the profession are well aware that great difference of opinion exists as to which setting of retorts is best, whether we consider the convenience of the stoker or the yield per mouthpiece. Some gentlemen prefer settings of three retorts heated by one furnace; some five retorts heated by two furnaces; while yet again it has recently been claimed that with one furnace and four retorts, arranged as they are at Dumbarton, as large a yield of gas is obtained as by any of the other modes, and at a less expenditure of labor and material. I cannot say that I am at all prejudiced against such ovens of retorts as require two furnaces to obtain the requisite heat, but reason whispers that if the coal can be thoroughly distilled in the four retorts heated by one furnace, that is the setting which ought to commend itself to the members of the profession. I may state that in our works at Port-Glasgow we have ovens containing three retorts in each, heated by one furnace, and I find that the ovens so constructed give a most satisfactory result, and that the yield of gas per ton, or the yield per mouthpiece, is about as good as could be looked for under any circumstances. I have wrought with ovens containing three, five, and seven retorts, and, as I have just stated, I find that ovens built as we have them here have given the best results.

Taking it for granted that the very best setting for retorts has been introduced, there are elements which go far toward either increasing or decreasing the cost of the gas. For instance, a clumsy or indolent workman may so charge the retorts that a large quantity of the valuable distillate may pass away through the ventilators on the roof of the retort house, or the heats may be allowed to get so low that the gases are not thoroughly removed from the amorphous mass in the retorts.

In order to facilitate charging, two or three machines have recently been brought before the profession; but, so far as I am in a position to judge, none of them seem at all well fitted for the task. The mechanism which appears to have attracted the greatest amount of attention, and the latest appliance, I think, which has been brought under the notice of gas managers, is that invented by Mr. W. J. Warner, of South Shields, whose ability in another branch of mechanics, as applied to the measurement of gas, has won for him a high place in the fraternity of gas managers. I have not had the pleasure of seeing that machine working, but I have consulted the drawings of it, and I have had conversations on the subject with gentlemen who went to Jarrow specially to see the plan in operation, and the conclusion at which I have arrived is that machinery of much simpler construction must be invented before it can become an efficient substitute for hand labor. For the Warner charger and drawer the retort house must be specially constructed; and even admitting that it saves manual labor—a proposition which I am not disposed to admit—the expenses of making new erections and introducing costly machinery would be more than existing companies or corporations would be inclined to sanction. With the number of men employed controlling the machine, attending to the actuating motors, and hoisting and carrying out the char, I am convinced that the retorts could be charged in an equally short time as the machine takes to do the work, and there is therefore just so much less capital to pay for out of the profits arising from the manufacture of gas.

While I say this, I do not despair of the arrival of the days when mechanical stokers will displace hand labor, and the sooner the better, for the stoker's occupation is a slavish one. I do not forget that inventions meant to supplant the laborer and mechanic were not perfected in a day. History teaches us that years of patient study and observation must intervene between the original design and the ultimately perfect machine. We have not far to go for an example. On the other side of the Clyde, and under the shadows of Dumbarton rocks, one may see any day the first marine engine made by Napier, and if he takes the trouble to compare it with the enormous and highly finished engines now supplied to steam vessels, he will see at a glance that the science of mechanics has made rapid and wonderful progress within the past forty years.

I do not think we shall require to wait so long for the perfection of the mechanical stoker; but of this I am sure, that unless the machinery is simple, easily handled, and capable of being applied to any setting of retorts, the day will be far distant when mechanical stokers will meet with general approbation.

There are, however, other reasons why gas should be economically produced besides those I have mentioned. Gas does not stand alone in the field of artificial lighting. It has now many competitors, from the powerful electric light down to the halfpenny dip; and it is amongst the lower class of competitors, rather than among the higher, that it has anything to fear. Paraffine, in my opinion, is by far a more dangerous rival than electricity. It is produced at a cheap rate; a lamp in which to consume the oil can be had for a mere bagatelle; and the light which it affords is by no means insignificant, or to be despised. Then it has this further advantage, that in burning oil the consumer does not require to leave a deposit of money with anyone; and this alone, in the eyes of many short-sighted people, is a high recommendation in its favor. While paraffine has these advantages, you have to put on the other side its disadvantages. The filling of the reservoirs is attended with a nasty odor; the material of which the upper part of the lamp is constructed is often brittle and easily broken; and the slightest carelessness on the part of a child or menial might lead to disastrous results in the way of fire. So much for paraffine.

Now permit me to draw your attention for a minute or two longer to the subject of electricity, which at present occupies so much of public attention. After watching the various phases of this question within the past two years—for that really is the period since it came to be regarded as a formidable rival of gas in the domain of public and domestic lighting—I am forced to the conclusion that if ever gas is compelled to play "second fiddle," it will

not be to electricity. At this time of day it is useless to indulge in idle regrets that the scare caused by the announcement of Mr. Edison's discovery should have been productive of so much damage to gas stocks; but if that scare caused the unwary and nervous to smart, it had a beneficial influence upon the manufacture of gas, and its proper distribution and consumption. Inventors endeavored to devise means whereby gas could be better and more economically consumed, and the result has been a decided victory in favor of gas. Unquestionably, if the desire is to illuminate a large space, and if an unsteady light and the greater expense of production do not form important factors in the calculation, electricity is a useful illuminant, but in no other circumstances. Hitherto it has been found impossible so to divide electricity as to produce, in our rooms and in our workshops, a multiplication of small lights, and it has been found equally difficult to store the subtle fluid in such quantities as to be of any practical value. While for the purpose of making a show, or, as is some instances, when it is used where careful discrimination of color is necessary, electricity may be adopted, yet in the extensive field of domestic lighting gas stands unrivalled.

Within the period during which the electric light was all the rage, gas engineers have not been idle. Improved burners, combinations of already well-known burners, and particular and patented modes of placing them, have shown to the public that if a strong flood of light is really requisite for a courtyard, a hall, or an important crossing, it can at once be easily obtained by the use of gas. Therefore, so far from electricity having done any harm to the manufacture of gas, it has resulted in good. It has given an impetus to all concerned in its production, and I make bold to say that the public have within the past two years learned more of the good qualities and useful purposes to which gas can be turned, than almost since the day of its first introduction. The scare is now numbered among the things that were, but I hope that those interested in the promotion of gas interests will not "lie idly on their oars," and wait again for a "fresh stirring of the pool." Our cry should be "Excelsior." Let us utilize gas to the utmost extent, and in the most approved way; and then should the day ever come again when the cry is raised of "Wolf! wolf!" the public will be better able to estimate it at its true value.

This leads me on to say a few words upon the question of encouraging the more extensive use of gas at the domestic hearth. Most of you are aware that gas works are not employed up to their full strength. At certain seasons no doubt there is a heavy drain upon the resources of all works; but during the summer-time, and often during the prevalence of daylight the full complement of retorts is not in active use. Here, then, we have a serious loss, for capital unemployed always means decreased profits at the end of the financial year. I should like to see our Scotch gas companies and corporations emulate English towns, and encourage the day consumption of gas for the purposes of cooking and for producing motive power. The gas-cooking stove is but a thing of yesterday, and yet, in my opinion, it is destined to play an important part in connection with our manufacture. Gas companies by offering inducements to people to introduce these clean and handy stoves might, in a short time, so augment the demand for supplies of gas that all the retorts in the works could be kept in constant use in summer as well as in winter, in daylight as well as in darkness. Of course it would be for each to consider his own special conditions in offering inducements to consumers; but I should be inclined to suggest that stoves, like meters, should be let out on hire, with the option to the user to purchase right off or to make so many payments. Or, again, arrangements might be made with landlords of houses to introduce a suitable stove to every kitchen, so that tenants, in moving from one house to another, would not require to sever connections in order to remove the stoves. When once the public come to consider how cheaply, how cleanly, and how easily they can, by the use of gas stoves, cook their daily food, I am certain we shall hear fewer complaints about the non-employment of plant in our works. It might be a consideration for companies if they desired to stimulate the industry of gas making, whether they should not allow a certain percentage of discount to all consumers who use gas both for cooking and lighting.

Then there is another consideration on this same topic. Through the perfection of the heating stove, gas may in the future be more largely run upon. Those who have been accustomed to the open fire are, no doubt, prejudiced in its favor, and this, too, although they are fully aware that one-half of the coal put upon the fire passes away without doing any good in the way of heating. The prejudice of these people must be respected, but at the same time it must be broken down, and the best way to do this is to encourage the introduction of gas heating stoves. When the air in a room is raised to a comfortable temperature, and suitable ventilation provided for carrying away the air vitiated by breathing, we may expect not only greater comfort to the people, but more healthy houses. And in fostering and encouraging the introduction of such stoves, gas companies will not only be forwarding their own interests, but will materially contribute to the welfare of the communities amidst which they are placed.

There is another most important way in which the use of gas should be encouraged—I mean using it as a motive power. You have seen that lately some most ingenious, simple and useful gas engines have been invented, and are now being brought under the notice of the public. Where only a small amount of power is required I know of no motor that will answer the purpose so well as a good gas engine. It can be applied to so many various purposes, such as driving printing presses and sewing machines, turning lathes, etc., and it can even be applied with great benefit and economy in some of our churches, for driving the organ bellows.

And now, gentlemen, you will see, from the few observations I have just made, that many and various are the ways in which gas can be used, and when the people come to use it, as shortly I am convinced they will use it, for other than domestic purposes, then we shall be enabled, on account of the larger consumption, to produce the article at a much cheaper rate than it has ever been done in the past.

I might, gentlemen, have said a little on some of the other matters connected with the manufacture of gas, such as condensing and scrubbing, purification, leakage, meters, etc.; but I have purposely refrained from doing so, as several of these subjects will be handled, and I have no doubt ably handled, by some of the members of the Association, at a later stage of the present proceedings; and from the discussions that will follow I hope much information will be obtained on these subjects.

I cannot close my remarks without a reference to the present position of our Association; and it gives me great pleasure indeed to be able to congratulate you on its prosperous condition. During the past six months no deaths have taken place amongst our number, and no calls whatever have been made upon our benevolent fund. This fund, I am glad to inform you, still remains untouched, and from information I have received from the Treasurer, I am also glad to be able to state that the managers or working fund is in a very healthy state. The general Committee have been most assiduous in their labors during the past half year, and to them are we indebted for the prosperous state in which our Association stands.

Death from Gas.

The Board of Coroners was yesterday notified that Sofia Ingenito, twenty-one years old, had been suffocated by inhaling gas. which had escaped from an open burner in her room at the Anson House, No. 76 Spring street.—N. Y. *Herald*, Nov. 1st.

Another case of suffocation from gas has come to light, the victim being a young man named Thomas Jackson, son of a farmer of that name residing on the Dundas-road. He came to Toronto quite recently, and engaged with Mr. Wm. Boyd, carriage agent, corner of Mill and Cherry streets. On Monday night he retired to bed in the best of health, and yesterday morning he was found dead by Mr. Boyd who went to call him. He had turned out the light, but had not turned off the gas properly, and when his room door was opened the place was full of it. Dr. Riddel was notified of the occurrence, but he saw no occasion for holding an inquest. It appears that Mrs. Boyd spoke to young Jackson previous to his retiring about the way in which he should turn off the gas.—Toronto *Globe*, Nov. 3d.

Bertha Weise, a servant in the employ of Mr. Isaac Deutsch, at No. 223 Henry street, was suffocated yesterday by inhaling gas from a burner in her bedroom. The girl arrived in this city a few days ago on the steamer Wieland from Germany. She was taught by her mistress how to turn off the gas, but it is supposed that she made a mistake.—N. Y. *Herald*, Nov. 5th.

Scranton, Pa., November 9th.—At an early hour this morning Charles Mulroony, aged twenty-four, residing in Hyde Park, was found in an unconscious condition in a room at the Scranton House, on Lackawanna avenue. He engaged the room last night. When the room was opened it was found to be filled with gas. Strenuous efforts to resuscitate him were made but in vain. He suffered great pain. He blew out the gas, it is supposed, instead of turning it off.—*Evening Telegram*, Nov. 9th.

In the broad silk department of W. H. Copcutt & Co.'s silk factory, Nepperhan avenue, Yonkers, on Friday morning, by the escaping gas, about 15 of the employees of that room were prostrated.—Yonkers *Gazettee*, Oct. 16.

The Edison Electric Light.

The Edison Electric Light Company has levied an assessment of $60 per share on its stockholders, and the books have been closed for that purpose to remain so until Dec. 1. It is claimed that more money was needed to carry on experiments than was anticipated, and advances were obtained in consequence from some of the larger stockholders until the total sum due now reaches $180,000.

The assessment is for the purpose of paying this, the original capital being $300,000. Certificates of indebtedness will be given to those who pay up, which will be interchangeable into new stock when the capital is increased. A meeting with this object in view is to be held shortly.—N. Y *Times*, Nov. 6th.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

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TUESDAY, NOV. 16, 1880.

Official Report of Examinations of Gas for two Weeks ending Nov. 13, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1880. Nov.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
1	Between	23.72	18.67	26.20	22.58	19.78	27.42
	9.30 A.M.						
3	and	23.78	18.01	26.13	20.73	19.99	29.85
4		21.45	18.81	26.6:	21.88	19.96	28.95
5	1 P.M.	24.27	19.07	25.88	23.06	20.08	28.55
6		24.04	19.19	25.59	22.37	19.89	29.30
	Averag	23.45	18.75	26.09	22.12	19.94	28.81
8		24.23	18.24	26.03	22.99	19.19	28.10
9		22.89	18.35	26.10	22.61	21.29	27.34
10		25.68	18.33	25.64	22.54	19.84	27.12
11		26.94	19.03	26.12	23.60	19.77	25.85
12		28.05	18.90	25.15	23.22	20.35	27.54
13		25.45	18.56	26.36	23.85	19.56	26.73
	Average	25.54	18.57	25.90	23.13	20.00	27.11

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

Election of Mr. Samuel Prichitt as President of the Nashville Gas Co.—Mr. Samuel Prichitt was elected President of the Nashville Gas Light Company, to fill the unexpired term made vacant by the death of Mr. Samuel Watkins.

Captain Eads' Ship Railway.

The *Scientific American* of last week contains two full page illustrations of Captain Eads' proposed railway for transporting ships with their cargo across continents.

Captain Eads claims by his plan to be able to take loaded ships of the largest tonnage from one ocean to the other across the Isthmus of Pamama, as readily as can be done by a canal after the DeLessep plan, and at a much less cost for engineering construction.

The project is certainly bold and ingenious, and the projector anticipates no serious difficulties in carrying forward his enterprise.

The engravings referred to in the *Scientific American* show the proposed construction of not only the railroad, but the appliances for transferring the ships from the water to the rail.

A New Oil Can.

A New England man has lately invented an illuminating oil can. It is so arranged that the can holds the light and the oil, and is adapted for oiling machinery in the dark, and when in use the light, which is made after the bull's-eye pattern, strikes upon the point of tube that ejects the oil and enables the oiler to see just what he was doing. Its usefulness to locomotive engineers for oiling engines in the dark should make it a valuable tool for them. The oil cannot harden orbecome stiff, as the light in the can furnishes heat enough to keep it warm, and it can easily be carried in one hand.

Different sizes, intended for all kinds of work, will be made.—*Iron Age.*

Leakage of Gas in London.

Very considerable street excavations have just been made in the Mile End Road and other East-end thoroughfares of London, on account of a very considerable quantity of gas escaping at some points of the gas mains into the street sewers. The inhabitants are moving with the object of inducing the Legislature to make the general adoption of the subway system for water and gas mains compulsory.—*Review of Gas and Water Engineering.*

Large Gas Burners at Railway Stations.

The New Station in Queen Street, Glasgow, of the North British Railway Company, is, we understand, to be lighted by Messrs. George Bray and Co's. flat-flame burners. This firm has received an order for thirty lanterns, ten having burners of 140-candle power, ten of 100-candle power, and the remaining ten with burners of 60-candle power.

The flat-flame system is much upon the increase, and appears now to be very generally adopted.—*Review of Gas and Water Engineering.*

An Electric Hammer.

Messrs. Siemens and Halske, the well-known German electricians, have brought out a novelty, the electric hammer.

The devise consists of three hollow coils of insulated wire, having a movable core or rod of soft iron, which is free to move up and down under the axial attraction of the coils when a current circulates in them. The central coil is traversed by a constant current, which magnetizes the rod or hammer, and the two extreme coils are traversed by alternating currents from a dynamo-electric machine in such a manner that they alternately attract and repel the magnetic rod up and down, so as to make it beat like a hammer. The range of blow is limited on one side by a spiral spring placed within an elastic cushion. Of course a very great rapidity of action can be given to the hammer, while the arrangement is apparently applicable to working a rock drill.—*Iron Age.*

Prices of Gas Coal.

The following are the prices at which the companies mentioned are shipping coal:

	New York.	Baltimore.	S. Amboy
Penn.....	$5.25	$4.10	$4.80
Scott's Youghiogheny..	5.00	3.75	
Montauk.....	5.00	3.70	
Newburgh Orrel.....	5.00	3.75	
Tyrconnell	5.00	3.75	
Despard.....	5.00	3.75	
West Fairmount.....	5.00	3.75	

To give some idea of the relative prices at the East and the West we give the following quotations of coal furnished by the Fort Pitt Coal Company:

At Pitsburgh, f.o.b. cars....	$1.30	per ton of	2000 lbs.
At Cleveland, f.o.b. cars....	2.90	"	"
At " f o.b. vessels	3.05	"	"
At Buffalo, f.o.b. cars..	3.55	"	"
At Chicago, f.o.b. cars	3.60	"	"
At Indianapolis, f.o.b. cars.	3.00	"	"

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
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NOVEMBER 16, 1880.

☞ All communciations will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central.....	466,000	50	60	70
Harlem.....	1,800,000	50	72	77
" Bonds	170,000			103
Manhattan.....	4,000,000	50	180	185
Metropolitan.....	2,500,000	100	139	142
" Scrip...	$1,000,000	...	106	104
Mutual.....	5,000,000	100	70	75
" Bonds, gold.	900,000	1000	100	104
Municipal.....	1,500,000	100	175	180
" Bonds	750,000		106	110
New York.....	4,000,000	100	105	110
Northern.....	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	112	115
Citizens.....	1,200,000	20	60	65
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal.....	1,500,000	100	70	80
Peoples.....	1,000,000	10	30	35
" Bonds.....	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan.....	1,000,000	100	60	63
Nassau.....	1,000,000	25	40	50
" Ctfs.....	700,000	1000	85	95
Williamsburgh	1,000,000	50	65	70
" Bonds		...	98	103
Kings Co.....	135,000	100	60	70
" Bonds.....	40,000	—	—	—
Richmond Co., S. I.	300,000	...	75	80
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	75	80
" Bonds	200,000	1000	95	100
Citizens, Newark.....	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Consolidated, Balt.			84	85
Bonds....			109	110
East Boston, Mass...		25	114	120
Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	140	144
Hempstead, L. I.....	25,000	100	...	—

Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150.000	40	117½	
Jersey City	750,000	20	150	160
Jacksonville, Ill.....	120,000	50	100	...
Lewistown Maine...	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada....	2,000,000	100	148	149
New Haven, Conn...		25	140	150
Oakland, Cal.....			35	36
Peoples, Jersey City		...	85	90
" " Bds.				5
Pittsfield, Mass.....			120	130
Rochester. N. Y.....		50	70	80
" Citizens		100	30	35
Rondout & Kingston			75	80
St. Louis Missouri..	600 000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			73	74
Toledo, Ohio..... . .			95	97
Troy, Citizens..	600,000	100	—	—
Washington, D. C...	1,500,000	20	200	215
" Scrip	500,000	20	125	—
Woonsocket, R. I....	150,000	100	80	...
Wilmington, Del....		50	174	...
Yonkers.....		50	—	70

100 shares Manhattan Gas, sold at New York Stock Exchange, at 179½; 100 at 180. 50 Metropolitan, of New York, sold at auction, at 135.

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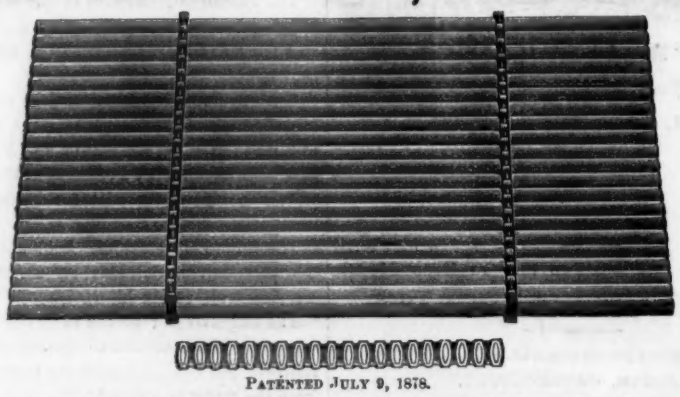

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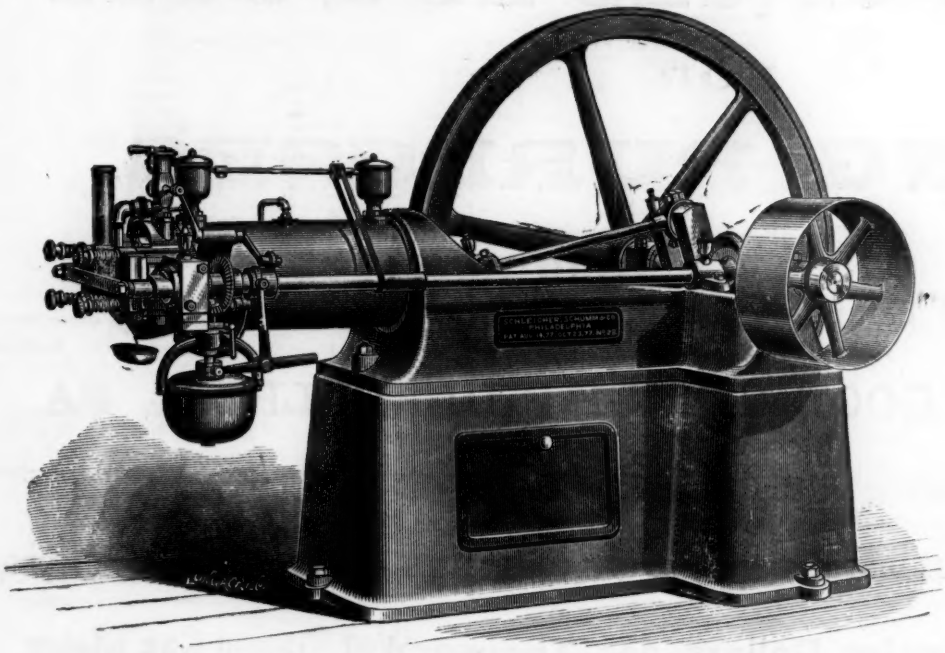

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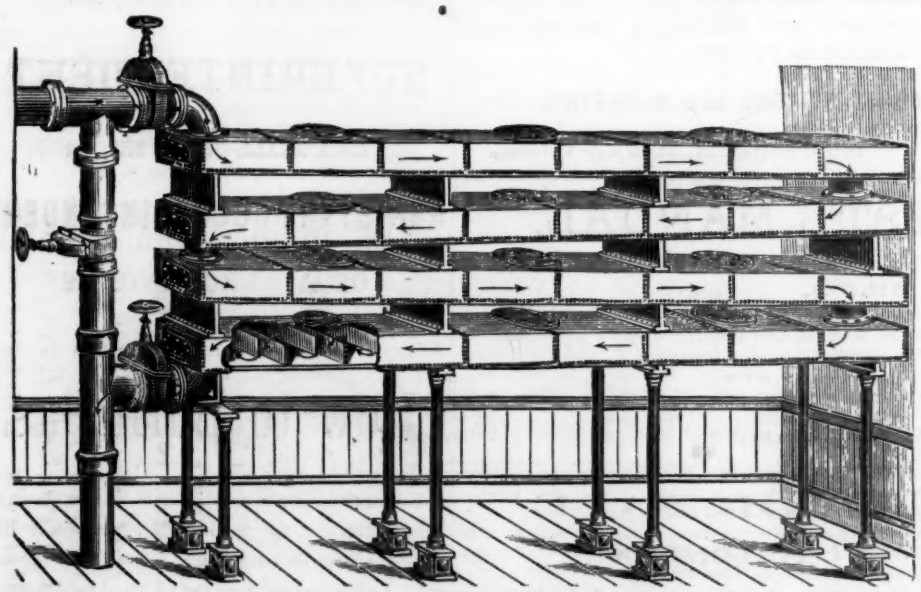

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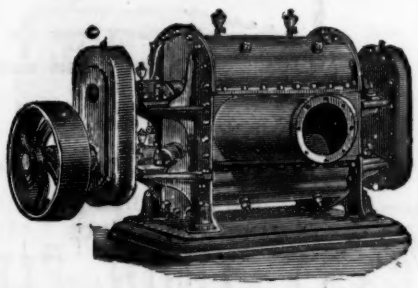

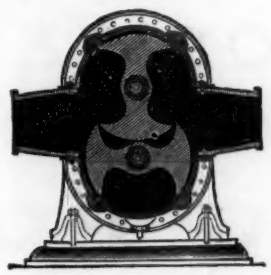

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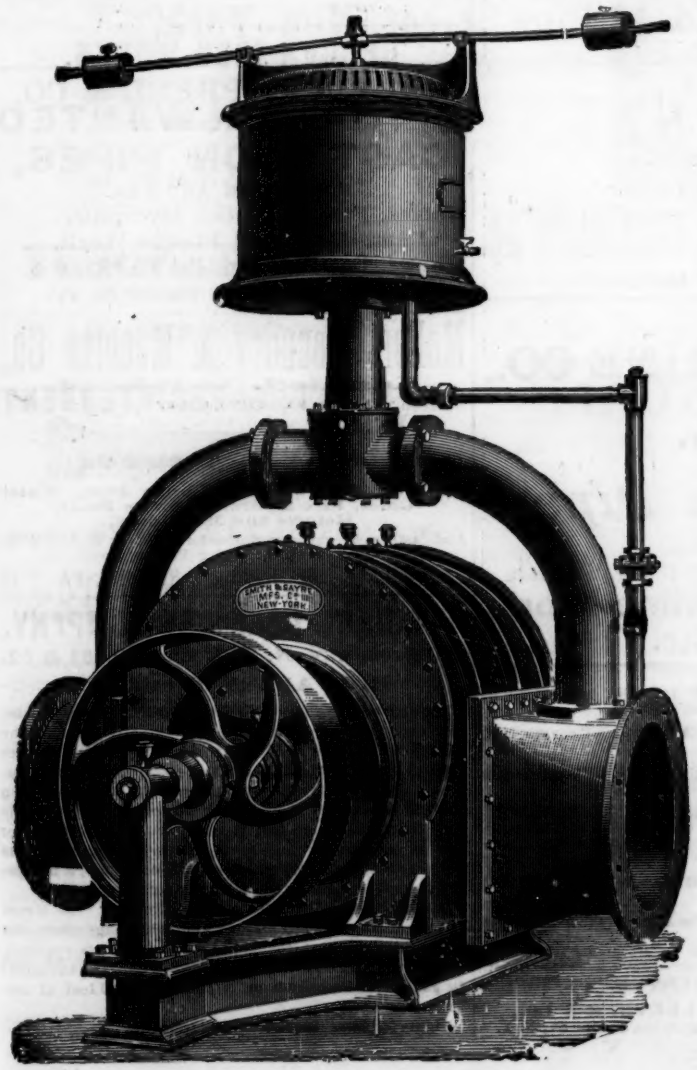

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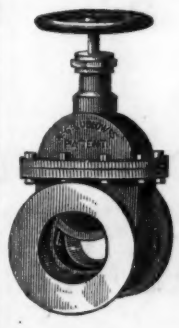

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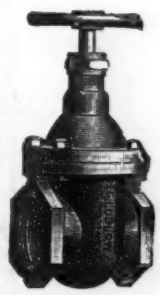

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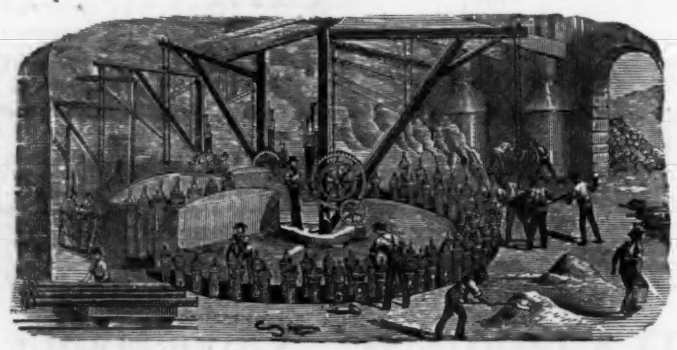

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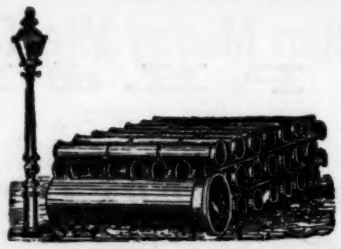

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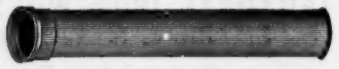

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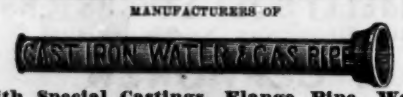

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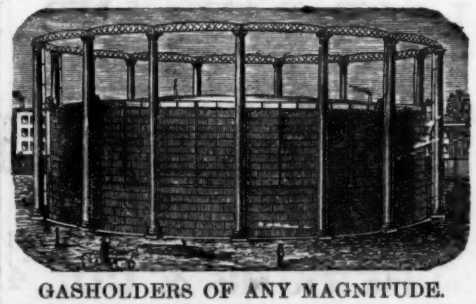

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351-1y

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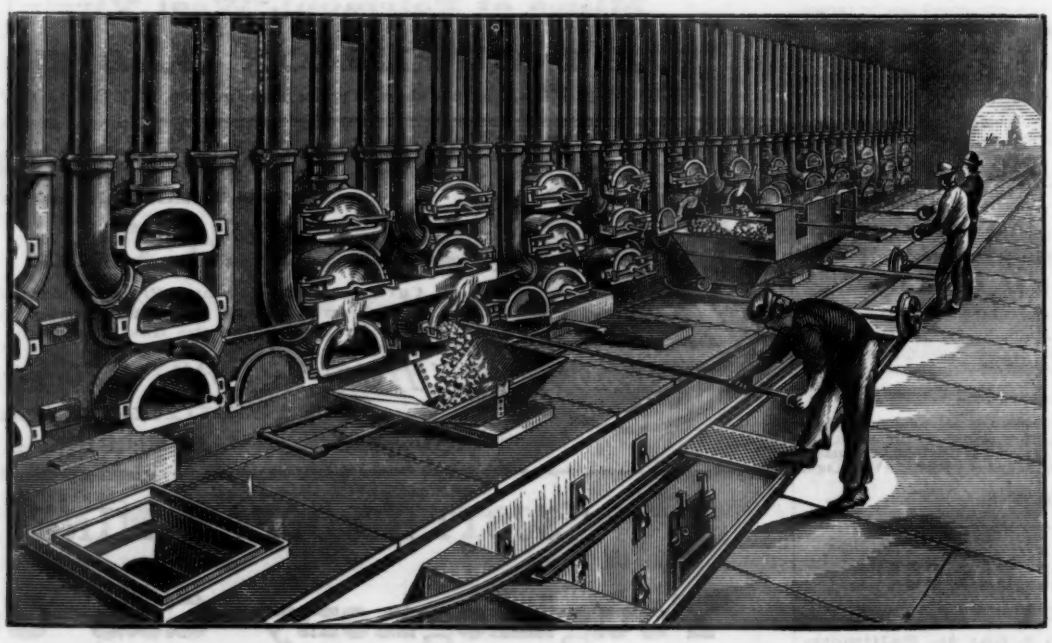

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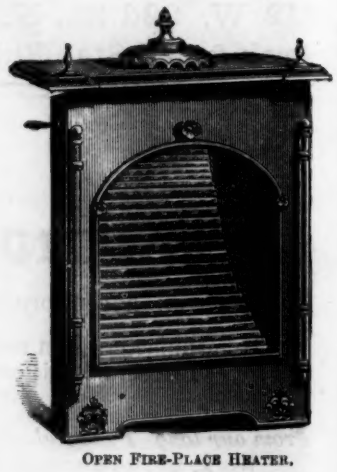

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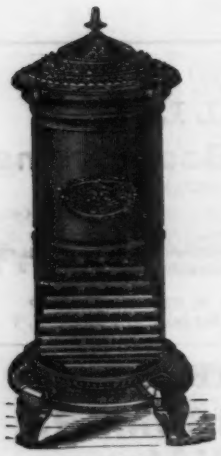

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